NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 7827

For Immediate Release
March 2, 1959

IRA H. ABBOTT NAMED DEPUTY DIRECTOR OF AERONAUTICAL AND SPACE RESEARCH

Ira H. Abbott has been appointed Deputy Director of Aeronautical and Space Research, T. Keith Glennan, Administrator of the National Aeronautics and Space Administration, announced today. He will continue to serve as Assistant Director of Research (Aerodynamics and Flight Mechanics), a position he has held since the NASA was established on October 1, 1958.

Abbott joined the National Advisory Committee for Aeronautics, the predecessor of the NASA, in 1929 as a junior aeronautical engineer at the Langley Aeronautical Laboratory, Virginia. During his 19 years at Langley he served as Assistant Chief of the Full-Scale Research Division and later Assistant Chief of the Research Department.

Transferred to NACA headquarters in Washington, D.C., in 1947 as Aeronautical Consultant, Abbott was named Assistant Director of Research (Aerodynamics) in 1949. Since the NASA was established, he has supervised basic research programs in fluid mechanics; aircraft, missile, and spacecraft aerodynamics, and control guidance and navigation.

Born July 18, 1906, at Wolfeboro, New Hampshire, Abbott was graduated from Newburyport (Massachusetts) High School. He received a Bachelor of Science degree from Massachusetts Institute of Technology in 1929.

Abbott is a member of the Civilian-Military Liaison Committee (authorized by the National Aeronautics and Space Act of 1958), and a Fellow of the Institute of the Aeronautical Sciences. From 1957 to 1958 he was Chairman of the Wind Tunnel Panel of NATO's Advisory Group on Aeronautical Research and Development.

Mr. and Mrs. Abbott (the former Martha Leola Streeter) and their three children live at 3704 Bradley Lane, Chevy Chase, Maryland.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 7827

FOR IMMEDIATE RELEASE
March 3, 1959

NOTE TO EDITORS:

The enclosed Waiver Regulations, the first of a series of interim NASA Patent Regulations, will be published in the "Federal Register" March 5, 1959.

The Waiver Regulations, based on subsection 305(f) of the National Aeronautics and Space Act of 1958, define NASA policy concerning: 1) class of inventions for which no waiver of U. S. rights will be made; 2) class of inventions for which waiver of rights will ordinarily be made; and 3) extent of those rights which the Government is waiving, e.g., title, exclusive license, non-exclusive license, or foreign rights.

The appendixes mentioned on pages 14 and 15 will be available later this week in the Office of Public Information.

John A. Johnson, General Counsel, will preside over a public hearing on the Waiver Regulations, set for Monday, May 18, 1959, in the NASA auditorium, 1520 H Street, N.W.

Other interim patent regulations which are now being prepared include procurement, technical data, licensing, and purchase of patent rights.

-END-

(To be published in the
Federal Register)

NOTICE

Notice is hereby given that the Administrator of the National Aeronautics and Space Administration, acting pursuant to subsection 305(f) of the National Aeronautics and Space Act of 1958, has prescribed interim regulations setting forth policies and procedures concerning waiver of all or any part of the rights of the United States with respect to inventions made in the performance of work required by contracts of the National Aeronautics and Space Administration. The interim regulations have been denominated Part 3 of the Patent Regulations of the National Aeronautics and Space Administration. Other parts of the Patent Regulations are in process of preparation.

All persons desiring to submit comments or suggestions concerning the interim regulations may do so by filing them with the General Counsel of the National Aeronautics and Space Administration, 1520 H Street, NW., Washington 25, D. C., not later than 60 days following publication of this notice in the Federal Register. On May 18, 1959, at 9:30 a.m. a public hearing will be held in the auditorium of the National Aeronautics and Space Administration, at the foregoing address, at which time and place oral presentation of comments or suggestions concerning the interim regulations may be made. In order that an agenda for such public hearing may be prepared, each person desiring to make an oral presentation is requested to submit a brief outline thereof to the General Counsel of the National Aeronautics and Space Administration not later than May 1, 1959.

The interim regulations are as follows:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Part 3 - Waivers Under Subsection 305(f)

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PATENT REGULATIONS

Part 3 - Waivers Under Subsection 305(f)

300 Scope of Part.

(a) The Administrator is authorized by subsection 305(f) of the National Aeronautics and Space Act of 1958, under such regulations as he shall prescribe, to waive all or any part of the rights of the United States with respect to any invention or class of inventions made or which may be made by any person or class of persons in the performance of any work required by any contract of the Administration if the Administrator determines that the interests of the United States will be served thereby.

(b) This Part sets forth the regulations which the Administrator has prescribed for the granting of such waivers, and contains the policies, requirements, and procedures governing the waiver of all or any part of the rights of the United States with respect to such inventions.

301 Applicability. This Part is applicable only to those inventions

(i) made in the performance of work under a contract of the Administration containing a "Property Rights in Inventions," clause, and

(ii) as to which the Administrator has made a determination, either pursuant to the presumptions contained in the "Property Rights in Inventions" clause or subsequent to a review of statements submitted by the contractor, that the invention was made by a person described in paragraphs (1) or (2) of subsection 305(a) of the Act and under the conditions therein described; and

(iii) as to which title in the United States has not been formalized by instruments of assignment.

302 Definitions. As used in this Part, the following terms have the meanings set forth below:

302.1 Administration and Administrator mean the National Aeronautics and Space Administration and the Administrator thereof, respectively.

302.2 Section 305 means Section 305 of the National Aeronautics and Space Act of 1958 (Public Law 85-568).

302.3 Inventions and Contributions Board means the Board of that name established by the Administrator pursuant to Section 305.

302.4 Board means the Inventions and Contributions Board.

302.5 The terms person, contract, and made have the same meanings as assigned in Section 305.

302.6 The term <u>contractor</u> includes a subcontractor, or the inventor when the inventor is not under an obligation to assign the invention to the contractor.

302.7 <u>Develop to the point of practical application</u>, referring to an invention to which this Part 3 is applicable, means manufactured, if a composition or product, practiced if a process, or operated if a machine, and under such conditions as to have established its availability to the public.

302.8 <u>Waiver</u> means the act of disclaiming title or of agreeing to grant <u>to the contractor</u> a license, or an assignment of foreign rights, under an invention to which this Part is applicable before execution of instruments of assignment of the invention to the United States.

302.9 <u>Instrument of waiver</u> means the document signed by the Administrator or his designee evidencing the waiver.

303 <u>Policy</u>. It is generally accepted that the interests of the United States are best served through the maintenance of a freely competitive economy supported by the United States Patent System as a stimulus for creative work. An important function of the patent, or of exclusive rights to or under the patent, is the protection which the patent or such rights gives to the investment of the person or firm who undertakes to develop the invention to the point of practical application. The Administrator considers that the interests of the United States will be served by making available to the public, under general licensing regulations promulgated under

subsection 305(g) of the Act, inventions owned by the United States, unless the interests of the United States would be better served by granting a waiver to the contractor. The Administrator further considers that waiver to the contractor would be in the interests of the United States where (i) the stimulus of ownership of patent rights will encourage the contractor to develop the invention to the point of practical application earlier than would otherwise be the case, or (ii) there are substantial equities justifying the retention of rights by the contractor.

304 Criteria For Granting Waivers.

304.1 Inventions not Generally Eligible for Waiver. Pending the further development of space technology, the interests of the United States would not generally be served by waiver of the rights of the United States with respect to any invention which is

(i) primarily adapted for and especially useful in the development and operation of vehicles, manned or unmanned, capable of flight without support from the atmosphere, or

(ii) of basic importance to the continued progress of aeronautical and space activities;

provided, that the foregoing shall not preclude the Administrator from granting a waiver as to such inventions under paragraph 304.3.

304.2 Prima Facie Case For Waiver. Except for inventions described in paragraph 304.1, the Administrator considers that a prima facie case that the interests of the United States would be served by waiver shall have been established when

(i) it is shown that the invention was conceived prior to and independently of, but was first actually reduced to practice in the performance of work under a contract of the Administration, and the invention is covered by a United States patent issued or application filed by or on behalf of the contractor prior to the award of the contract; or

(ii) it appears that the invention has only incidental utility in the conduct of activities with which the Administration is particularly concerned and has substantial promise of commercial utility; or

(iii) it is shown that the invention is directed specifically to a line of business of the contractor with respect to which the contractor's expenditure of funds in the field of technology to which the invention pertains has been large in comparison to the amount of funds paid or to be paid to the contractor under the contract in which the invention was made for research or development work in the same field of technology; or

(iv) the waiver requested is for a nonexclusive, nontransferable, royalty-free license under an invention which does not qualify for waiver of greater rights under circumstances (i) through (iii) above; or

(v) the waiver requested is for rights to an invention in a country or countries other than the United States in which the Administration does not desire to file an application for patent for such invention.

304.3 Other Inventions and Rights. The Administrator may grant whatever waiver of rights appears appropriate under the circumstances, under an invention which does not qualify for waiver under paragraph 304.2 whenever the contractor shows to the satisfaction of the Administrator that the grant of waiver under such an invention would be in the interests of the United States in accordance with the general policy enunciated in paragraph 303.

305 Conditions and Extent of Waiver.

305.1 General. The rights which the Administrator may waive under an invention may vary as to extent, i.e., title, exclusive license, or nonexclusive license, and as to the term of years. All waivers shall be subject to the reservation of an irrevocable, nonexclusive, nontransferable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States. No waiver shall be valid unless accepted in writing by the contractor. Instruments of waiver shall provide that the waiver is voidable at the option of the Administrator

(i) if the contractor shall have failed to comply with a material condition of the waiver, or

(ii) if it is subsequently discovered that the grant of the waiver was based upon misrepresentation of a material fact;

provided, however, that the inclusion of conditions in a waiver or instrument of waiver, requiring certain acts or reports from the contractor, shall not be deemed to be a contract requiring the performance of work within the meaning of subsection 305(b) of the Act; and provided further that inventions made by the contractor in connection with the development of an invention to the point of practical application as a part of compliance, or in attempting to comply, with a condition of a waiver or instrument of waiver, shall not be deemed from such fact alone to be inventions made in the performance of the type of work set forth in Section 305.

305.2 Conditions Applicable to Specific Rights. Generally, when the Administrator determines that waiver is in the interest of the United States, he will waive rights to the extent and on the further conditions set forth in paragraphs 305.3 through 305.7 below.

305.3 Title.

(a) Title to the invention for the full term of the life of the patent will be waived when the waiver is under category (i) of paragraph 304.2 or when such waiver is approved under paragraph 304.3.

(b) When the Administrator has determined that it is in the interests of the United States to waive rights under inventions falling within categories (ii) or (iii) of paragraph 304.2, the waiver granted will be the title to the invention, but such title shall be voidable at the option of the Administrator unless the contractor shall, on or before the end of the fifth year from the date of the contractor's acceptance of waiver, demonstrate to the Administrator that

(i) the invention has been developed to the point of practical application, or

(ii) the invention has been made available for licensing either royalty-free or at a reasonable royalty rate, or

(iii) there are circumstances justifying failure to realize the conditions of (i) and (ii) above and concurrently justifying a continuance of title in the contractor.

305.4 Exclusive License. The waiver may take the form of a grant of an exclusive license on appropriate terms and conditions if the contractor should request such a license.

305.5 Nonexclusive License. A nonexclusive license waived under category (iv) of paragraph 304.2 shall be voidable, at the option of the Administrator, after the end of the fifth year from the date of the contractor's acceptance of waiver, if

(i) the contractor, upon request by the Administrator, shall be unable to demonstrate that (A) the invention has been developed to the point of practical application, or (B) there are circumstances excusing the contractor from so developing the invention or justifying a continuance of the nonexclusive license to the contractor; and

(ii) the Administrator has not made the invention generally available for licensing, nor granted a license or other right which is not revocable or terminable at such time.

305.6 Foreign Rights. Waivers made under category (v) of paragraph 304.2 will be by disclaimer and assignment of title for the life of the patent in the foreign country for which the waiver is granted.

305.7 Special Conditions. In addition to the applicable conditions set forth in the preceding paragraphs, waivers shall be subject to (i) such special conditions as may be set forth in the instrument of waiver and (ii) the provisions of paragraph (f)(iii) of the "Property Rights in Inventions" clause used in contracts of the Administration.

306 Procedures.

306.1 Petition. Waivers will be granted only upon a petition addressed to the Administrator. Such petition shall

(i) identify by number and date the contract under which the invention was made or to which the invention relates,

(ii) identify the invention by name of inventor, brief description, and the location of records wherein the invention is disclosed,

(iii) state facts showing that the invention qualifies under the criteria of paragraph 304 for consideration for waiver,

(iv) specify the extent of waiver requested, i.e., title to the invention, exclusive license, non-exclusive license, or title to foreign rights; and in the case of foreign rights, specify the country or countries in which the contractor desires to file application for patents,

(v) state whether or not the contractor has filed or caused to be filed a patent application for such invention,

(vi) if a patent application has not been filed, present any information which the contractor wishes to submit concerning publication, public use, or public sale of the invention, which would indicate the need for prompt action on the petition.

(vii) include any additional statements, information, or reasons in support of its request which petitioner desires to submit,

(viii) be signed by the petitioner.

Any statements required to be furnished under (i) through (vii) above may be attached to the petition if suitably identified and cross-referenced in the petition.

306.2 Processing of Petitions.

(a) Petitions will be submitted to the Office of the General Counsel, National Aeronautics and Space Administration.

(b) The Assistant General Counsel for Patent Matters will review such petitions for compliance with paragraph 306.1 above and prepare a Findings of Fact and Recommendation to the Inventions and Contributions Board with respect to each such petition which will state

(i) whether, in his opinion, the petition sets forth facts which qualify the invention for waiver under one or more of the criteria in paragraph 304,

(ii) a recommendation that waiver in the extent requested either be or not be granted, or in the alternative, that a waiver in an extent different from that requested, be granted,

(iii) any special conditions which should be included in the instrument of waiver.

(c) The Inventions and Contributions Board will consider the petition and Findings of Fact and Recommendation of the Assistant General Counsel for Patent Matters and notify the petitioner --

(i) whether it proposes to recommend to the Administrator the granting of the waiver in the extent requested, in an extent different from that requested, or the denial of the request;

(ii) of any conditions upon which it proposes to recommend the granting of the waiver;

(iii) of the reasons for any action which is adverse to or different from the waiver requested by the petitioner; and

(iv) that the petitioner may, within 30 days from receipt of the notification, request an oral hearing before the Board, in the event the petitioner is not satisfied with the action the Board proposes to recommend.

(d) If the petitioner requests a hearing, the Board will set a place and date for such hearing, notify the petitioner and the Assistant General Counsel, and hold such hearing in accordance with rules approved by the Administrator.

(e) If the Board has proposed to recommend the granting of a waiver and the petitioner has not requested a hearing within 30 days as above provided, the Board shall transmit to the Administrator an instrument of waiver in the extent proposed to be granted for approval by the Administrator, together with its recommendation that the waiver be approved.

(f) After a hearing as provided in (d) above, the Board shall transmit to the Administrator the petition, the record of proceedings, its findings of fact with respect to the request for waiver, and its recommendation for action to be taken with respect thereto.

(g) The Administrator may either (i) approve the waiver and direct that the instrument of waiver be delivered to the petitioner; (ii) inform the petitioner of his decision if adverse; or (iii) refer the matter to the Board for further proceeding in accordance with his instructions.

306.3 <u>Procedure Pending Grant of Waiver When Statutory Bar is Running Against the Invention</u>. Whenever it appears that a statutory bar is running against the filing of an application for patent for the invention during the course of this procedure, and that delay in acting on the petition for waiver might result in loss of the patent rights in the invention, the Assistant General Counsel for Patent Matters shall arrange with the contractor for the preparation and filing of the patent application by the contractor pending the action on the waiver, subject to reimbursement of the reasonable costs of the contractor if the waiver is not approved in a form acceptable to the contractor.

306.4 <u>Form of Waiver</u>.

(a) <u>Assignment</u>. When waiver is approved for disclaimer of title, there will be furnished to the contractor an instrument of waiver which permits the contractor to retain title but requires the furnishing to the United States, as represented by the Administrator, at the time of filing the application for patent, a confirmatory license (prepared by the Government) of the rights reserved to the United States. When the waiver is approved under paragraph 305.3(a) the instrument of waiver will be in the form of Appendix A, and when the waiver is approved under paragraph 305.3(b), the instrument of waiver will be in the form of Appendix B which contains the additional conditions required by paragraph 305.3(b).

(b) Exclusive License. When the waiver is an exclusive license, there will be furnished an instrument of waiver which, in general, agrees to grant to the contractor, at the time the application is filed, an exclusive license, except for the rights reserved to the United States, upon the conditions that the contractor

(i) prepare the application for patent;

(ii) execute or cause to be executed instruments of mesne assignment of the invention (prepared by the Government) in favor of the United States, as represented by the Administrator;

(iii) forward to the Administrator such application for patent, properly executed, for filing in Patent Office, and such instruments of mesne assignment for acceptance by the Administrator;

(iv) arrange for prosecution of the application under an associate power of attorney and under the procedures and conditions set forth in the instrument of waiver; and

(v) such other conditions as are appropriate to the grant.

(c) Nonexclusive License. When the waiver is approved for nonexclusive license, there will be furnished to the contractor an instrument of waiver in the form of Appendix C granting an irrevocable, nonexclusive, and royalty-free license to the contractor (and its existing and future associated and affiliated companies, if any, within the corporate structure of which the contractor is a part), together with the right to sublicense others to the extent that the contractor is obligated prior to the contract to grant such sublicenses, which license and right shall be assignable to the successors of that part of the contractor's business to which such invention pertains. The instruments of mesne assignment, prepared by the Government for execution by contractor and delivery to the Administrator in accordance with paragraph (e) of the "Property Rights in Inventions" clause, will be subject to and acknowledge therein the reservation to the contractor of the license grant set out in the instrument of waiver.

(d) Foreign Rights. When the waiver is approved for territorial rights to an invention in any country or countries other than the United States, there will be furnished to the contractor an instrument of waiver in the form of Appendix D which will permit the contractor to prepare and file an application for patent in such other country or countries, subject to the contractor obtaining such licenses, or clearances as to secrecy, as may be necessary for exportation of such application and the filing thereof in such other country or countries. The instrument of waiver will also set forth an agreement to assign to the contractor the entire right, title, and interest in such invention in each foreign country as to which the rights are waived and in which an application is to be filed by the contractor, subject to the reservation of an irrevocable, nonexclusive, nontransferable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign Government pursuant to any treaty or agreement with the United States, upon the conditions that the contractor

(i) prepare without direct cost to the United States Government a United States patent application covering the invention;

(ii) execute or cause to be executed instruments of mesne assignment of the invention (prepared by the Government) in favor of the United States, as represented by the Administrator; and

(iii) forward to the Administrator such application for patent, properly executed, for filing in the Patent Office, and such instruments of mesne assignment for acceptance by the Administrator.

306.5 Effective Date. These regulations shall be effective upon publication in the Federal Register.

T. Keith Glennan

T. Keith Glennan
Administrator

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

PRESS CONFERENCE

5:00 P.M.
Wednesday
4 March 1959

MR. BONNEY: Ladies and gentlemen, if we are about ready to begin: To give you this report on the status of the historic travels of Pioneer IV we have two gentlemen this afternoon who are intimately acquainted with the payload and its trajectory. They are Dr. Homer Joseph Stewart, Director of the Office of Planning and Evaluation for NASA, a long-time veteran in rocketry on leave from Cal-Tech where he is associate professor and also very active in the workings of the Jet Propulsion Laboratory; the other gentleman is Mr. Clifford Cummings, also from NASA's JPL. He is the JPL resident representative here in Washington at NASA Headquarters.

Dr. Stewart has a brief statement that he would like to read. If we would let him get through with it before the questions start I think it might work out better.

DR. STEWART: At 12:10:54 a.m., EST on March 4, 1959 the United States launched the Pioneer space probe which is now grazing the gravitational field of the moon.

Pioneer IV will proceed in an orbit around the sun. It is anticipated that the 13.4 pound package containing scientific instruments will have a lifetime comparable to the life expectancy of our universe.

The launching of Pioneer IV was under the direction of the National Aeronautics and Space Administration. Technical supervision was handled by NASA's Jet Propulsion Laboratory at the California Institute of Technology in cooperation with the United States Ballistic Missile Agency.

The JPL data reduction center at Pasadena, California, which is charged with evaluating the tracking data, provides this preliminary information on the launch and Pioneer IV's flight. First the expected time of closest approach to the moon is 5:24 p.m. today, just in a few minutes. Second, the closest approach distance to the moon is 37,000 miles. The position at that time is 236,000 miles from the surface of the earth and the velocity then is 4,525 miles an hour. At that time it will be 7.1 degrees ahead of the moon and 5.7 degrees south of the moon.

If you want to see the place on the earth directly underneath the test vehicle at that time it will be located at longitude 159 degrees east and 22.6 degrees south.

The launch velocity at injection into space, we have a better estimate now. The estimate now is that it was 24,791 miles per hour, which is 199 miles an hour in excess of the required escape velocity at the injection altitude.

On the basis of this data we are now in position to estimate the heliocentric orbit, that is the orbit around the sun. Our estimate is that the perihelion position, the position when it is closest to the sun, will be reached on March 17, 1959, at which time it will be a little less than 92,000,000 miles from the sun -- 91,744,000 miles from the sun. At that point it is 1,168,000 miles inside the earth's orbit.

Correspondingly, the aphelion distance, the position furthest from the sun, is expected to be reached on September 29, this year, at which time it should be 105,829,000 miles from the sun, which is about 12,917,000 miles outside the earth's orbit.

The plane in which the Pioneer IV is traveling is very close to the plane of the ecliptic. It differs from the plane of the ecliptic by an angle of only about a fifth of a degree and the ascending node will be reached on September 10 which is just before the time of most distant from the sun.

The long-range tracking was accomplished by the ten foot dish antenna at Puerto Rico and the 85-foot dish antenna at Goldstone tracking station north of Barstow, in California, both of which were operated by JPL, and also by the 250-foot radio telescope at Jodrell Bank in Manchester, England.

The Puerto Rico dish was designed only to track to 50,000 miles but the crew at Puerto Rico managed to hold on to the signal to a distance of 104,000 miles yesterday when it finally went below the horizon and they lost it. So it was a very fine performance.

Goldstone has a design range of 400,000 miles and is still working well. It acquired the signal this morning at 7:34 and lost it just a few minutes ago at 4:14, as the eastern rotation of the earth caused the Pioneer IV to set in the west.

Meanwhile, Jodrell Bank should be able to pick it up at 12:30 a.m. tomorrow and should be able to hold on until 7:45 a.m. which is about the same time we expect Goldstone to pick it up again tomorrow.

Yesterday there was a time when all three of these stations were tracking simultaneously for about 15 minutes in the early morning, providing a very good check on the position.

The mercury batteries(which power) the radio transmitter in the probe which radiates about 180 milliwatts have a life of about 90 hours. In other words, the batteries should last another fifty hours. This should give us about roughly two days of tracking after the passage of the moon.

Dr. James Van Allen, head of the physics department at the State University of Iowa, who designed the radiation experiment, in Pioneer IV, says the telemetry tapes containing radiation data indicate the instrumentation is working well. He said the Pioneer IV is producing a good, sensible signal.

A quick look at the radiation data reveals no new belts of radiation, Dr. Van Allen says. It will take him sometime to reduce the data.

The probe contains the following instrumentation, to summarize: a battery powered radio transmitter with three channels of telemetry, two Geiger Mueller tubes to measure radiation. One tube had been shielded by four millimeters of lead to cut out all but the high energy radiation. A photoelectric sensor shaped like a pistol, at such angle to command the view of the moon as it passes. It was designed to react from a light from the moon at a distance of less than 22,000 miles and to send a signal to indicate it had passed the moon. Since the miss is likely to be 37,000 miles it is likely this sensor will not react. We will have a further opportunity tomorrow to see if we get any reaction.

A de-spin mechanism was activated to slow down the rotating spin of the Pioneer IV and this was done by releasing two small weights of seven grams each to slow the rotational speed from 324 RPM down to about 13. This worked satisfactorily last night.

That concludes the information.

QUESTION: What is the orbital period of this thing, Doctor?

DR. STEWART: The orbital period is 392 days. I have a sketch here on the board to give you some idea of what it is like. In order to show the trajectory, I emphasized the --

QUESTION: Doctor, before you leave the despin, did it activate, and when?

DR. STEWART: It activated at 11:32 yesterday morning.

Here I have accentuated it. Here is essentially the launch position and the time, roughly, where we are now, where the orbit of the Pioneer 4 is very close to the Earth.

As it goes in, it will come slightly inside the Earth's orbit and reach the point closest to the sun on March 19th. Then, as it goes on around, it will come outside the Earth's orbit again and reach the furthest out point on September 29th, then pass back in this neighborhood again.

QUESTION: At this time it is going ahead of the Earth, is it not?

DR. STEWART: At this time it is going ahead of the Earth.

QUESTION: When will the Earth catch up and it will fall behind?

DR. STEWART: It will be going ahead of the Earth and going faster than the Earth until somewhere out about this point here. About this point its velocity will fall down to the same value as the Earth's and then after that the Earth will be catching up. I don't know where it will be when the Earth passes ahead.

QUESTION: Can you calculate the catch-up point on the calendar?

DR. STEWART: The catch-up point has to be very close to here.

QUESTION: Dr. Stewart, you said the perihelion was less than 92 million miles, about 91,744,000 miles?

DR. STEWART: Right.

QUESTION: Is that less than the Earth's own perihelion?

DR. STEWART: No, it is not. It is less than the Earth's average distance. It is not les s than the Earth's own perihelion.

QUESTION: Do you have that figure?

DR. STEWART: No, I don't have it right here. I think --

QUESTION: Is it accurate to say this will always be between the Earth and Mars?

DR. STEWART: No. As you can see here, there is a small period of time when it comes inside the Earth's orbit, but it doesn't come very far inside the Earth's orbit.

QUESTION: What was the figure you gave us on that? I didn't get it.

DR. STEWART: The figure I gave you was that its perihelion position, as I indicate there on March 17th, is 1,168,000 miles inside the Earth's mean distance from the sun. But the Earth's orbit is slightly eccentric, too. I don't have the precise numbers on the Earth's orbit here for a comparison.

QUESTION: Is it the 17th or the 19th? You have two different figures.

DR. STEWART: The 17th is correct.

QUESTION: Dr. Stewart, how does this compare with Russia's Mechta?

DR. STEWART: It is very much the same kind of an orbit. They fired their rocket in the corresponding phase of the moon, so they went out ahead of the Earth the same way as Pioneer 4.

As I recall their conclusion, it was that the period was about fifteen months, which is slightly longer. That was the Russian estimate. That is slightly longer than this, which means it goes out a little further toward Mars than this does.

QUESTION: Dr. Stewart, if these batteries work for the designed ninety hours, approximately how far out will this thing be, and will any one of the tracking stations be able to pick up its signals?

DR. STEWART: Fortunately we ran through this calculation. It turns out that the ninety hours life, as you might coincidentally expect, would bring it out to a distance from the Earth of about 400,000 miles, which was the design range for the Goldstone antenna. So it is not too surprising that the two numbers come out the same.

QUESTION: Dr. Stewart, this figure you gave of 236,000 miles above the Earth, do you mean thatthat is the distance that it has traveled from the Earth, including the various --

DR. STEWART: No, that is the straight-line distance, the distance from here to here (indicating).

QUESTION: How far is the moon from the Earth at this point?

DR. STEWART: It is a little less than that. It is about 4,000 miles less than that. You see the point of closest approach -- it is passing in front of it -- is just when it is slightly beyond the moon, as far as distance from the Earth is concerned.

QUESTION: Doctor, this is a question from the audience. Will Mechta and Pioneer 4 ever meet?

DR. STEWART: I would say that is even less likely than that either one of them should ever hit the Earth again.

QUESTION: Can you calculate in hours how many hours in advance of a crash landing you passed the moon? How much longer should it have taken to reach there to crash land?

DR. STEWART: It is an inter-related problem. You can't really answer it quite that way. The moon is traveling 2,100 miles an hour, and it is 36,000 miles ahead of it and about 4,000 miles to the side. So if you just do that, you could say eighteen or seventeen hours. This isn't right.

QUESTION: I am trying to get a figure. By how many hours did you miss?

DR. STEWART: You can't quite do it that way. If the time of passage had been a little shorter and the path hadn't been curved quite around so much, then we might have hit it.

QUESTION: You would still have been five and a half degrees south of it, wouldn't you?

DR. STEWART: Yes. There are three errors that you have to balance to hit it, the elevation error, the azimuth error and velocity error. You have to get all three right.

QUESTION: Will you give us those figures on the three errors?

DR. STEWART: I don't have the figures, as a matter of fact.

QUESTION: Dr. Stewart, in listing the instrumentation in this thing, you neglected to mention a magnetometer device, which I understood was aboard.

DR. STEWART: I have seen reference to that. Unfortunately, the reference is not correct. There was no magnetometer.

QUESTION: Dr. Stewart, do you have any information on any following launch rockets which may also be going into orbit around the sun?

DR. STEWART: Not at this time.

QUESTION: In other words, all that we know is that the payload is doing what it is supposed to do?

DR. STEWART: That is right.

QUESTION: Will there ever be any time when we can conceivably check anything else?

DR. STEWART: On this one? I really doubt it, because the batteries will go dead in a very short time and after that it is just another little bit of meteoric material except that this happens to have a little higher polish on some of it than a lot of the things up there.

QUESTION: Is it possible that there is more than just a payload?

DR. STEWART: The launching rocket is following along behind it.

QUESTION: You say that because it should be. Do you know that for a fact?

DR. STEWART: If it isn't, the payload wouldn't be there, either.

QUESTION: Will there ever be a time, assuming that your figures are accurate, that this thing could be either picked up again in some way or spotted again at any other time in the future?

DR. STEWART: I think I can answer that this way: If the tracking after it passes the moon is of sufficient accuracy, then we may be able to make a good trajectory, good orbital computation of the time of the next approach to the Earth. The chances are very poor that we would have sufficient accuracy so that at the time of closest approach it could be observed with an astronomical instrument. But in principle, it is possible. If our measurements were of sufficient accuracy and it came close enough, you could pick it up with an astronomical instrument. It is very unlikely.

QUESTION: Approximately when?

DR. STEWART: I just haven't thought that through. I would have to run around and see. Something like 18 months.

QUESTION: Approximately how far from Earth?

DR. STEWART: If the 18 months is right, it would probably be within 5,000,000 miles or so.

QUESTION: Dr. Stewart, since you lost sight of this thing at 4:14, are we safe in saying it is still up and will be back around at the proper time, 5:24?

DR. STEWART: I am sure you are, because I can't see what could have happened in that short interval.

QUESTION: How many hours have you had when you had no tracking at all?

DR. STEWART: There was about an eight-hour interval -- about a ten-hour interval last night, and there will be possibly about another one tonight. It depends on whether the Jodrell Bank people get up real early and pick it up.

QUESTION: How is it that the tracking facilities at Hilo were not available to you?

DR. STEWART: These were not under our control and I expect they were needed for other purposes.

QUESTION: Whose control were they under?

DR. STEWART: I believe the Pacific Missile Range.

QUESTION: Were they still trying to find Discoverer, is that your point?

DR. STEWART: I have no idea.

QUESTION: Dr. Stewart, could you give us the figures again on the relationship to the moon?

DR. STEWART: Relationship to the moon?

QUESTION: So many points ahead and below and so on?

DR. STEWART: Yes, with respect to the angular coordinates with respect to the moon, at the time of closest passage 7.1 degrees east of the moon -- that is ahead of it -- and 5.7 degrees south of the moon.

QUESTION: You mean below?

DR. STEWART: Below.

QUESTION: Will the velocity of this decrease below 4525 miles per hour?

DR. STEWART: Yes, it will decrease a small amount.

QUESTION: Do you know what the low point will be?

DR. STEWART: We have a number of 3400 miles per hour. That is a pretty good number.

QUESTION: Will it then speed up?

DR. STEWART: Actually, the problem gets very complex because as it goes around its ellipse, around the sun, with respect to the sun its speed is maximum on this March 17 point and minimum out at the September 29, 1959 point. With it going around and the earth going it is a very complex question.

QUESTION: What I am trying to determine is whether it is going to get a gravitational kick from the moon or slow down?

DR. STEWART: I did make an estimate of that. It went into the moon's field close enough so that it influenced the trajectory slightly. But it was just grazing across at a distance when the change in the speed of the object was very, very slight; hardly measurable.

On the other hand, it was in the field long enough so that there was a slight effect on the angle.

QUESTION: Bent toward the moon?

DR. STEWART: It bent toward the moon.

QUESTION: Can you tell us how much, how many degrees?

DR. STEWART: I don't have that here.

QUESTION: In the tracking of the 90-hour period will it enter in in that time in the heliocentric orbit or not?

DR. STEWART: For most purposes it already is there. This perturbation to the moon which it is going through at the moment is a very weak perturbation. For at least a day it has been in the position where the solar gravitational field is far stronger than the earth.

QUESTION: But what I am getting at is in the 90 hours then you should be able to get an accurate information to predict the orbit?

DR. STEWART: Yes. By the time it is picked up tomorrow morning the perturbation due to the earth and the moon are already pretty small, so the data obtained then should extrapolate well.

QUESTION: Isn't it the same answer that we had before on the reason that you didn't use solar batteries on this thing, at the time you started this operation, because solar batteries were not far enough along?

MR. CUMMINGS: Basically that is correct. And we face the fact that even if we had more time capacity in terms of having more battery life or having solar batteries, we still have a radiated power problem. To generate enough power in the vehicle, to radiate enough power so we could receive it on the earth, we would have to have a very large transmitter which meant more weight also.

QUESTION: So that future probes might not have solar batteries? It might still be better to have mercury batteries?

MR. CUMMINGS: When we are probing at distances like this, yes. When we start probing at very extreme distances we will have to start thinking of other methods.

QUESTION: Dr. Stewart, we were given to understand that the programmed velocity at injection of this thing was about 24,890 miles. You attained 24,791. Now is this deficiency related to the fact that it is 5-1/2 degrees south of the moon? In other words, if it had gone at the program velocity would it have been higher?

DR. STEWART: I think they were probably independent errors. The analysis has not been made. I think they are independent.

One thing I probably should say, as Mr. Bonney mentioned: In speaking of this object as going at some 4,000 miles an hour ahead of the earth here, you have to remember that that adds on to the 66,000 miles an hour that the earth is going around the sun. So that really with respect to the sun it is up around 70,000 miles an hour.

QUESTION: Dr. Stewart, you had in there an experiment to test the signal of the transmitter. Have you had any result on that?

DR. STEWART: The signal there did not come through cleanly and they are having to work with it to see whether they can get anything out of it or not.

QUESTION: Dr. Stewart, do you have any refined calculations on the error of aim?

DR. STEWART: They have them essentially but I do not have an analysis of them here. The injection parameters, of which the one I gave you was the velocity, with that also went the determination of the angle at injection. So that these could be compared back with the program expectation and looked at. That has not been done.

QUESTION: Could you give us a little more of a fill-in on what you have recieved from that Geiger Counter which is shielded by four millimeters of lead?

DR. STEWART: I cannot. All I can say beyond what I read you from Van Allen's remarks is that it was just the statement that things were working well and there were no unexpected busts or things of that sort.

QUESTION: In other words, you haven't run into any solar clouds of gas so far as you know?

DR. STEWART: We haven't, so far as we know.

QUESTION: Or nothing unusual in the way of cosmic rays either, of extremely hard radiation?

DR. STEWART: It has been counting regularly, but the point is that it is regular. There have been no unusually high instances.

QUESTION: Not more than two belts?

DR. STEWART: That is the implication.

QUESTION: Have you been able to predict yet whether you will be able to track this thing all the way out to the end of its 90 hours, or will you lose it because of revolution of the earth sometime before that and not pick it up again?

DR. STEWART: It is lost right now. We should pick it up tomorrow morning at about 7:45 and follow through for about another ten hours. We then expect to lose it again and pick it up again on Friday. The 90 hours runs out Friday afternoon.

QUESTION: So you should have it in when the 90 hours runs?

DR. STEWART: we should be able to track it up to about that point. Whether they pick it up again Saturday if we are lucky enough and the batteries hold out longer than usual we don't know. Or if we are unusually lucky and they hold out to Saturday.

QUESTION: You thought originally Goldstone had a fix on it when it passed the moon?

DR. STEWART: That is right. We missed it by about an hour today.

QUESTION: Doctor, this question could be asked in other words. This photoelectric sensor, do we know whether it triggered or not?

DR. STEWART: It should not trigger because it does not come in the proper orientation with respect to the moon.

QUESTION: It is too far away for the image? So far as you know it has not triggered?

DR. STEWART: There was some trouble with the signal. We will have to wait until tomorrow to see what comes up.

QUESTION: This had to have a certain intensity of light before it would kick off the signal, is that it?

DR. STEWART: It wasn't the intensity. It was the size of the image. There were two photocells and the image had to cover both of them before it would trigger.

QUESTION: How accurate would be your figure of 37,000 miles? What kind of slack have you in there?

DR. STEWART: It hasn't changed by as much as a thousand miles since eight hours after launch. So I would say that the accuracy is almost certainly better than a thousand miles.

QUESTION: Earlier today a figure was being given of 37,000 plus or minus 2,000. That is why I wonder.

DR. STEWART: That is why I didn't put in the plus or minus. It hasn't been changing more than a thousand.

QUESTION: Dr. Stewart, could you speak for the government now as to whethere there is complete satisfaction of the performance of this thing?

DR. STEWART: There were two or three minor items that didn't work completely up to the pre-program expectation. I would say that the test is completely satisfactory.

QUESTION: Could you tell us what those two or three minor items were?

DR. STEWART: We would have hoped to come closer to the moon so that we would have a better chance to see if there are local radiation peaks --

QUESTION: Would you repeat that, please?

DR. STEWART: I say we would have hoped to come closer to the moon so as to have a better chance of determining whether there was a local radiation peak. That is certainly the most significant factor.

QUESTION: Dr. Stewart, this is the final one of your five so-called, the ones that they had planned, the lunar probes. Can you tell us where we go from here, what your next launch estimate is and what you might be trying to do?

DR. STEWART: I would prefer not to.

QUESTION: Can you give us a rough guess? How many more this year, for example?

DR. STEWART: To tell the truth, I think I can properly say that the next launching is scheduled as a Vanguard, I believe. I am just not real up to date on this schedule at the moment.

QUESTION: Can this thing be regarded as a preparatory exercise to a shoot at the planet Venus such as Mr. Brooks suggested last Sunday?

DR. STEWART: This was always considered as an initial series in deep space probes.

QUESTION: Dr. Stewart, how can we shoot for Venus when we don't have the radar for tracking beyond 400,000 miles?

QUESTION: What was the answer to that first question?

DR. STEWART: The answer is that it has always been considered as an initial attempt at deep space probes. This is the only sensible way to look at it.

With regard to your other question, the question of the range at which reception can be obtained is complicated by the factor of power. That is, at a greater distance if you radiate more power you can still receive it. If you go twice as far and put out four times the power you will still receive it. This runs you into battery trouble if you use continuous transmission as we did on Pioneer IV.

But if you use intermittent transmission and transmit only five percent of the time or two percent of the time, you can run your power up quite substantially and carry your reception over a greater distance. There are ways around it.

QUESTION: How far out did the Russians track Mechta?

DR. STEWART: As I recall, they announced that they received signals for one day after the time of passage.

QUESTION: You don't recall an altitude figure?

DR. STEWART: No.

QUESTION: We will get it for about two days after passage?

DR. STEWART: This is our expectation at the moment.

QUESTION: If you can pick this thing up with 180 milliwatts of power at 400,000 miles, as you expect to at Goldstone, does it follow then that you would need 100 times that much power to pick it up at the range of Venus, which is about 40,000,000 miles?

DR. STEWART: Wait a minute. 400,000, 40,000,000, that is a ratio of 100. So it would be 10,000.

QUESTION: Will you need ten thousand times as much power in your signal to get a signal back from that range?

DR. STEWART: To bring back the same signal, yes. To bring back a simpler signal with less information you would have less power.

QUESTION: Could you use solar cells in this instance and store up power in a solar battery on a Venus trip?

DR. STEWART: Yes, this is certainly possible.

QUESTION: Could you make any comparisons between the value of the scientific findings of this probe and the Lunik?

DR. STEWART: I really can't. I have seen no formal results released on the Russian experiment.

QUESTION: Or from what equipment they carried could you judge?

DR. STEWART: As I recall, their equipment was reasonably similar except I believe they had a magnetometer aboard which we did not. I think that is the principal difference, as I recall.

QUESTION: Dr. Stewart, except for the negative finding that there is nothing new in the Van Allen department, what scientific information are you getting from this probe?

DR. STEWART: I would say that was quite interesting.

QUESTION: But are you getting any other?

DR. STEWART: This is the principal experiment. The other technical items, I would say the principal experiment other than that is the technological experiment of the communications system. We are getting very good information on how that is working.

Another minor result, for example, the radiation heat design of the satellite is working out well. The average temperature inside the instrument case is checked out at about 44 degrees centigrade. That is 111 degrees Fahrenheit, which is in the range we wanted it to be. So the radiation design proved accurate.

QUESTION: It hasn't varied much from that?

DR. STEWART: No.

QUESTION: What did it start out at, Dr. Stewart?

DR. STEWART: I don't remember. I believe they remarked that it was a little hotter just after launching and settled down very quickly.

QUESTION: Did that one have black and white stripes up the side of it or was it solid gold like this one?

DR. STEWART: It is like the model here, the gold finish.

QUESTION: How do you control temperature then, by spin?

DR. STEWART: Wait a minute. I was wrong, it is striped.

QUESTION: What percentage of the surface is black, do you know, Mr. Cummings?

MR. CUMMINGS: I don't remember the percentages.

QUESTION: Dr. Stewart, this spinning mechanism on the top of the Jupiter rocket, we have two figures. One is 700 RPM and another is 550. You say it is spinning at about 324 RPM and the de-spin mechanism slowed it down to 13.

DR. STEWART: This was after it left the Jupiter. This was after the second, third, and fourth stage combustion processes, too.

QUESTION: What would slow this down in space?

DR. STEWART: The rocket gases leaving the nozzle carry with them angular momentum and you can have a change. We have noticed small changes before. This is one point we will have to study a little further, though.

QUESTION: Dr. Stewart, we were told by Dr. Rees on the night of the launch that the first stage had fired perfectly and that the deviation in trajectory must have been in one of the later stages. Has there been any further information?

DR. STEWART: There is not. Either in the coasting period or in the later stages is, I think, where the deviation has to have its source.

QUESTION: Dr. Stewart, in looking at these figures that Herb is writing on the board, 105,829,000 is pretty precise. To what degree of error is this subject? Plus or minus how many miles?

DR. STEWART: It is not very many thousands of miles. We are using the Earth as a moving body, which gives us the Earth's distance from the sun, which we measure the variation from.

QUESTION: How about percentage-wise? Plus or minus one percent, or half a percent?

DR. STEWART: Percentage-wise it would probably sound awfully good because 92 million, as I say, is what we are starting with. I would think it probably is better than one percent, anyway.

QUESTION: You mean the error is less than one percent?

DR. STEWART: Yes. I would think that we shouldn't be as much as a million miles in error. I have no quantitative basis of saying that except just general knowledge of how the computations are done.

QUESTION: For reference purposes, can you give us the perihelion of the Earth?

DR. STEWART: I am sorry, I didn't think to bring that. As soon as you started asking questions I could see that is something I should have looked up.

QUESTION: Have you reported the injection altitude?

DR. STEWART: I don't believe we have. It was about 150 miles.

QUESTION: Is Jodrell Bank equipped to record the telemeter, or just to track the probe?

DR. STEWART: I have heard that they are recording some telemetery. I have heard no remark on the quality or the nature of what they are recording.

QUESTION: Dr. Stewart, has this information been gathered and disseminated in an IGY life procedure? Will it all be available? Will you publish all of this?

DR. STEWART: This is the general intention. Rather than IGY Headquarters, it will come through NASA here. I believe Walt Bonney could better answer this.

MR. BONNEY: It is my understanding that we will publish the results but will turn them over to the COSPAR Committee, which is picking up the work thatthe IGY Committee did, and in that way it will be made available to scientists throughout the world.

Is John Truesdale here? Is that correct, John?

MR. TRUESDALE: That is generally correct. It will be made available to all the other countries.

QUESTION: Did your despinning mechanism work to what it was programmed to? You gave a figure of about eleven hours.

DR. STEWART: I think it was programmed for ten hours. It was actually eleven hours when it went. It was about an hour late.

QUESTION: Have you any idea what caused the delay?

DR. STEWART: No, none except these little hydraulic timers are not awfully precise devices.

QUESTION: Does that make any difference?

DR. STEWART: It made no difference.

QUESTION: Mr. Cummings, how is the cone striped?

MR. CUMMINGS: It is striped vertically. I am sorry, I don't have the pattern here.

QUESTION: All black and white?

MR. CUMMINGS: It is an oxide that has been placed on it, white oxide. I don't know the widths of it.

QUESTION: Is it gold and white or black and white over the gold?

QUESTION: It is darkish gray and white.

MR. CUMMINGS: It is gray and white.

QUESTION: There was no gold showing? No gold showing at all?

QUESTION: What are the two colors? Gold and black, or what?

MR. CUMMINGS: I did not see the final one.

DR. STEWART: I did not see it.

QUESTION: I think there was no gold showing through.

QUESTION: Can Jodrell Bank follow this farther out than Goldstone?

DR. STEWART: I really don't know. You see, their antenna is a larger one than Goldstone. On the other hand, their antenna was made for general purpose usage. Whether their tolerances on their design are adequate so that their extra size can be taken to advantage, I just don't know.

QUESTION: Did you use the minitrack stations at all with this?

DR. STEWART: They were used in the launching phase, yes.

QUESTION: You had three stations. Do you have plans to add more tracking stations for the subsequent shoots?

DR. STEWART: Yes, in a later period when we want to do more ambitious things we will need more complete tracking data.

QUESTION: Is three the bare minimum that you can track something with?

DR. STEWART: The three we have now are below the bare minimum, as you can see, because even counting Jodrell Bank, Goldstone, and Puerto Rico, they are below the bare minimum for long-term use because we lose the thing completely for extended periods.

QUESTION: Ideally, what should you have?

DR. STEWART: Ideally we should have one or two more.

QUESTION: Is the spin to the right, clockwise -- looking to the back -- or to the left?

DR. STEWART: Clockwise.

MR. CUMMINGS: Looking to the back.

QUESTION: Would it be correct to say you lose this for about ten hours in each 24-hour period?

DR. STEWART: A little more than that. They track right down so that twelve hours comes out pretty close.

MR. BONNEY: We will have a transcript on this tomorrow. Also, we have a call in to JPL as to the width of the stripes and their colors. If you call in a little later, we will have that for you.

(The conference was concluded at 5:45 p.m.)

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FOR RELEASE
11 A.M. March 5, 1959

NASA PLANS FOR THE FUTURE

by

Dr. Homer J. Stewart
Director, Office of Program Planning and Evaluation
National Aeronautics and Space Administration

For Presentation to the
Mid-America Missile Briefing
Conrad Hilton Hotel
Chicago, Illinois
March 5, 1959

The National Aeronautics and Space Administration (NASA) came into existence on October 1, 1958. It has now been in operation for nearly six months. For most of this period the primary organizational activity has been concerned with organizing a general plan of operations, both technically and administratively, and with undertaking the most pressing aspects so that we may, as soon as possible, clear our way to a general approach to our future programs. It is important to remember that prior to the formal activation of NASA there were a number of programs started within the Department of Defense after discussion with members of the NACA which were oriented toward the interests of a civilian agency and which constitute the flight experimental program with which we are currently involved. These include the remaining rounds of the Vanguard program, the group of five lunar probe experiments, and two additional satellite experiments. These programs were transferred to NASA and are now being completed.

The last two weeks have marked two significant milestones in our process of becoming a fully operational agency in the new field of space flight. First, the Vanguard team, now part of NASA, successfully placed in orbit a fully instrumented IGY satellite package containing a meteorological experiment on February 17, 1959. Second, the Jet Propulsion Laboratory, also now a NASA establishment, in cooperation with the Army Ballistic Missile Agency, has successfully launched the first American artificial planetoid on March 3, 1959, and this experimental equipment has now passed the moon and is well established in its orbit around the sun. The primary experiment, in this case, is a measurement of the cosmic radiation density in interplanetary space.

A fundamental question with which we have had to concern ourselves in defining a program for the future is the question of the interests and the potentialities which justify and require our activity in this new field of space flight. This is a complex question which cannot be answered simply but there are a number of important factors which, taken together, define our interest. The first factor arises from the fact that even the very small amount of scientific equipment which we have thus far placed in a free space environment in satellites or deep space probes has held experimental measurements which disclose phenomena which were unexpected and consequently of great value from a scientific standpoint. Specifically, the measurements made with the Explorer and Pioneer vehicles on the radiation belts surrounding the earth have caused us to revise completely our views of the outer structure of the earth's atmosphere. The validity of space experiments as an intellectual stimulus in scientific fields is already clearly demonstrated.

A second factor which supports our interest arises from the potential contributions to the civilian economy of our country. The two areas in which such a contribution may most clearly be expected are meteorology and long-distance communications. While the recent Vanguard launching should demonstrate the potential uses of satellite equipment for meteorological purposes and should yield experimental results of great interest, we must expect that many experiments will have to be performed and many lengthy analyses be carried out before this can be reduced to a regular operational technique. Similarly, the initial communication experiment carried in an Atlas over the Christmas season was only the first step in a lengthy research process which must be carried out before we will arrive at the point, for example, of worldwide television transmission.

It is quite obvious that meteorological and communications applications which may be important to our civilian economy would also be of great significance to our military establishments. In addition, there are other potential military applications -- for example, in the fields of reconnaissance and navigation.

Finally, and in some ways most important of all, the fact that we are now in a sufficiently advanced position to commence an exploration of the vast reaches of space surrounding the earth has made these regions the newest frontier in science and technology. Either we choose to follow through and accept the challenge, or we retire and permit more energetic people to carry on the exploration of this frontier. I am sure that the American people, as a whole, insist most strongly that we participate in all new activities of this nature. All of these various factors influence our determination to investigate the properties of all extra-terrestrial space and all of them influence the program which we are developing to carry forward this exploration.

It is best to think of the program at NASA as having three primary facets. The first facet is the research effort in all of the fields of science and engineering which contribute to aeronautical and space activities. This work is largely a continuation of the activities of the old NACA Laboratories, strengthened by the addition of the Jet Propulsion Laboratory and of the groups that were transferred to NASA from the Naval Research Laboratory. These research efforts necessarily establish the basis for the kind of activities which we will be pursuing a decade in the future, and they also improve the general level of knowledge and our general capabilities in the current fields of activity. One of the many pressing problems which we must pursue concerns those techniques in the field of rocketry which can permit us to develop equipment which is both highly efficient and highly reliable. If we are to carry out an extensive program of manned exploration in space we must develop equipment which will permit this effort without undue risk to the crew.

A second facet of the NASA program is the development of new kinds of rocket vehicles and propulsion systems which can clearly expand our capability for action beyond our current, only partially satisfactory, capability. These activities will first be focused upon the development of equipment which can exploit efficiently the capabilities of our present large military rockets, such as the Atlas. I may note, for example, that the Atlas is potentially capable of launching into orbit a payload of four or five tons, whereas the only use so far has carried a payload of only 150 pounds. We have also taken the step of initiating development work of a rocket engine having a thrust of one to one-and-a-half million pounds in a single combustion chamber. While it is too early to define precisely the kind of equipment which we will build and the purposes for which we will use such a device it is probably sufficient to note that equipment on this scale will undoubtedly be required if we are to carry out a manned exploration of the moon. The initiation of this critical item may well be expected to save us many years of time when our thoughts are sufficiently organized so that we can define in detail these more ambitious goals.

The third facet of the NASA program, and the one which is currently the most dramatic, concerns our use of rocket equipment to carry out scientific and other kinds of investigations in the environment of free space. In this research area we are carrying out three different kinds of activities. The first is concerned with investigating the problems of manned space flight. Our project Mercury has as a goal placing a man in orbital environment for a period of a few hours, or at most a few days, and returning him safely to earth. This goal is being pursued with all of the energy that we can muster. A second application of space flight concerns the use of space for scientific experiment. As I have noted earlier, even with the small-scale and relatively inefficient equipment which we now have, valuable results have been obtained and we must follow through and expand our efforts as more efficient equipment becomes available. Thirdly, we are making preliminary experiments of the kinds of things which may have civilian applications in the fields of meteorology and communications.

It is appropriate, on this occasion, for me to expand my earlier remarks on the second facet of the NASA program, the development of new, more flexible, and more efficient hardware to increase our capacity for space activities. The only equipments with which we have carried out successful satellite missions are the Explorer, the Vanguard, and the Atlas. The June II has just launched our first successful lunar or escape mission, Pioneer IV. None of these launching systems are efficiently designed. The ratio of take-off gross weight to ultimate payload weight in the satellite vehicles varies from about 6000 (for Vanguard I) to 3000 (for Explorer), to 1500 (for the Atlas) and to 1000 (for Vanguard II). An efficient design of a satellite launching vehicle, using only the present level of technology should achieve a ratio of 40 or 50. Similarly, the ratio for the Pioneer IV is about 10,000 whereas an efficient design should achieve a ratio of 150 or 200 for an escape mission. The present systems do not match the criteria of efficient systems because they were not designed for space uses (except for Vanguard, which is properly proportioned, but is too small for high efficiency).

The primary problem in the NASA vehicle development program is thus the problem of obtaining for our use some suitably designed equipment which can efficiently utilize the really impressive capabilities of our large military rockets, the ICBM's and the IRBM's. We are currently in an advanced planning phase of Project Vega, a project designed to exploit the Atlas with conventional techniques on a minimum time scale. We expect that announcements of the contract structure for carrying out this project can soon be made. A second similar project, Centaur, which is planned on a longer time scale to determine the gains that can be achieved by use of high-energy propellants, has already been initiated by ARPA and will become a NASA program in the next fiscal year. When these new kinds of efficient equipment become available, we will be able to expand greatly the scope of our space activities.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

FOR RELEASE:
3 p.m. EST
Thursday, March 5, 1959

EXPLORING THE NEW FRONTIERS OF SPACE

By Hugh L. Dryden
Deputy Administrator
National Aeronautics and Space Administration
Western Space Age Conference
Los Angeles, California, March 5, 1959

A few weeks ago I had the pleasure of hearing Sir Vivian Fuchs describe the first overland crossing of the continent of Antarctica from the Weddell Sea to the Ross Sea in the South Pole, and to see the film accord of this great accomplishment. Earlier I had heard first-hand accounts of the pioneering exploits of Operation Deep Freeze, of the hardships and heroism of Navy men and civilian scientists in carrying out the program of the International Geophysical Year at the bottom of the world. Thus as the new frontier of space confronts us, the East frontiers of the surface of the earth are yielding to the perseverance and ingenuity of man.

As we examine the equipment developed to permit the survival and useful activity of man in the extreme cold, darkness, high winds, and blinding of the Antarctic snow, we appreciate anew the adaptability of man in mastering new frontiers. Man is a delicate yet resiliant creature, adapted to live in an atmosphere environment whose chemical composition, pressure, and temperature lie within very narrow limits. The temperature zones of the earth are our natural home. We have lived here, and multiplied for many thousands of years. Our bodies have adapted themselves to some extent to the normal fluctuations of weather by developing an internal thermostat that keeps our internal organs at constant temperature. We burn more internal fuel to add heat, and reduce blood circulation in the vessels near the skin and if necessary exude water to be evaporated to keep us cool. Beyond the limits of these controls, we wrap ourselves in mufflers, coats, gloves, and overshoes or we retreat from the weather into the artificial environment of homes and offices.

Within the past half century man has progressed far in the exploration of the atmosphere. Here too, in an external environment of extremely low pressure and temperature, in which he could survive only for seconds if unprotected, man has had the ingenuity to provide his own environment, to make himself at home, here as in the jungle, in the desert, in the Himalayas or in the Arctic and Antarctic. We might say that man's only natural habitat is the cosmos. His "normal" environment is the one that he creates for himself.

The environment of space will be mastered in the same fashion. The astronaut in his air conditioned pressure suit will have the same protective environment as the Arctic explorer or the winter sportsman in the high Sierras. There will be unprecedented problems, hazardous and strange difficulties, but these are to be met as pioneers on our planet have always met them, with planning and preparation and with fortitude and courage. I have a deep conviction that man will succeed in his resolve to establish himself in space, and that the exploration of space will bring great practical benefits for the peaceful pursuits of mankind and for military applications, if needed.

The exploration of sapce has already begun with the launching of unmanned satellites and space probes carrying scientific apparatus. These new tools of scientific research promise to rapidly advance our understanding of the space environment and of many phenomena previously studied only by indirect means. The ionosphere, so important to radio communication, is now accessible to direct measurement. The structure and composition of the high upper atmosphere, cosmic rays in interplanetary space, charged particles, meteoric dust, solar phenomena, surface meteorology, magnetic storms, and interrelations between various phenomena represent a few of the areas in which systematic study promises a deeper understanding. This deeper understanding yields information useful in communications, in meteorology, in navigation, in the design and operation of manned space vehicles, and for possible military purposes.

Last year, American scientists were successful in placing five instrumented satellites in orbit. We launched three space probes, of which two traveled beyond the Earth farther than any man-made objects up to that time.

Only two weeks ago, as you know, we established another Vanguard satellite, with a so-called "weather eye," to observe the cloud cover surrounding our planet. We are stepping up the frequency of our satellite and space probe launchings,

These accomplishments in space research have been gratifying to us at NASA. They have done a great deal to enhance the prestige of the United States in the worldwide competition to achieve mastery in space. More important, they have brought us a wealth of new data on conditions in the Earth's atmosphere and in the nearly space. For example, the three Explorer satellites in 1958 brought us our first information about the dual band of high-intensity radiation that rings our globe, trapped in its magnetic field.

Again, the recent Vanguard has permitted us, for the first time, to look down on this planet from a vantage point hundreds of miles away, and see its white mantle of cloud, as if we were watching it through a telescope from Mars or the Moon. When these observations are compared and evaluated, we will have a much clearer idea of the visual impression which the Earth presents in space, and of the phenomena that produce our weather.

We have marshalled a great part of our national resources -- in money, in productive capacity, in scientific and technological talent -- to launch these inanimate messengers into space, and to guide them on their elliptical courses, among the age-old masses of metal, rock, and enveloping gas that now occupy the universe. We expect to add to our knowledge of the universe and to increase our eventual control on our own terrestrial environment. We expect to know excactly the conditions in space in order to make possible the travel of man himself in space.

We have been approaching human flight in space by the gradual technique of ranging continually higher in aircraft, into regions where the atmosphere merges imperceptibly into the vacuum of space. We have now decided also to proceed from the missile by direct method of catapulting a manned capsule into orbit, above the aerodynamic limits of the atmosphere, and bringing it down with a suitable recovery system.

The first approach is represented by the X-15, the new experimental rocket craft, which was built in California and is now undergoing its preliminary trials at Edwards Air Force Base, in the California desert. This is a project very close to all of us in NASA. It is the latest in a series of rocket-powered vehicles, with normal aircraft wings and control surfaces, reaching back to the years immediately after World War II, almost 15 years ago.

The National Advisory Committee for Aeronautics, which was the predecessor and the nucleus of NASA, participated with the Armed Forces in the development of these advanced vehicles, and in the research conducted with them. They included the X-2, in which the current records for both altitude and speed in piloted craft were set -- the altitude record of 24 miles by the late Captain Iven Kincheloe, and the speed mark of 2,260 miles per hour by the late Captain Milburn Apt.

The X-15 is a hybrid craft, capable of operating either in the atmosphere or in space. To conserve its rocket propellants, it is carried up to an altitude or 8 miles or more, under the bomb bay of a B-52, which takes the place of a rocket booster such as we use to lift a satellite vehicle above the denser part of the atmosphere. There it takes off on its powered flight, possible to more than 50 miles above the Earth, and coasts back down like a glider, to land on the dry lake bed at Edwards.

In the rarefied air that constitutes the border region of space, the X-15 uses a new system of small jets to control its attitude and direction. Space control of attitude can be studied, as well as the problems of reentry into the atmosphere with a winged vehicle while keeping reentry heating of the structure within safe limits. By suitable flight paths the pilot also may subject himself to the condition of weightlessness for several minutes.

This line of development of winged vehicles will lead eventually to a winged space craft capable of maneuvering in the atmosphere and landing at a desired air field.. Better materials or methods of heat protection will be required as well as more powerful engines and probably external rocket boosters.

The second method of putting a man in space is to inclose him in a capsule, mounted in the nose of a rocket booster, and launch him into orbit, like the Vanguard or Explorer satellites. Here the essential difference is that the capsule has no wings, and cannot glide home as the X-15 does. It has to be slowed down by some such device as retro-rockets, to cause it to travel downward from orbit and finally the capsule must be slowed down and lowered to the ground by parachute.

This is by far the simplest way to get a human being into space -- and the one which makes the fullest use of the enormous energy in rockets. Once aloft, at an altitude of about 120 miles, the capsule can remain for a long period, circling around the Earth at orbital velocity, without any further expenditure of power at this atltitude, well below the Great Radiation Belt, as shielding from radiation is required.

A man is considerably larger and heavier than any instrument package that we have placed in orbit, up to now. In addition, he requires equipment weighing hundreds of pounds, to maintain the air pressure which his body needs, to protect him from extreme acceleration and deceleration, to supply him with fresh oxygen and remove the carbon dioxide which he exhales, to provide him with food and water and other necessities, including apparatus to make scientific observations, and to control the conditions of the flight.

Until recently, rocket boosters capable of lifting all this weight into orbit were not available to us. They were still under development for the military missile program. But in the last few months, that program has progressed to the point where some of these rockets can soon be put at our disposal for scientific exploration in space.

The organization of NASA, last October, coincided with this new capability in our research planning. And so, one of the first projects undertaken by NASA was to bring together manufacturers of airframes and missile systems, to define the specifications needed in a capsule which would carry a human passenger into orbit. Our studies culminated on November 17th, in an invitation to submit detailed proposals for the development of such a capsule.

On January 12th -- only three months after the start of this project -- NASA announced that one of the proposals had been accepted. It calls for an outlay of approximately $18,000,000, and for the delivery of a dozen of these capsules in the next year or so. Some will be used in exhaustive tests of the vehicle and its booster system. One, finally, will carry the first

American into an orbit in space.

This program, which we call Project Mercury, is already under way. An important part of it is the selection and training of the man who will make the first flight. For we now have the basic rocket booster -- an intercontinental ballistic missile which has demonstrated its capability -- while the requirements for the capsule have been determined, after years of experimentation by aeromedical research laboratories. Fitting the two together, so that they will work with a high degree of reliability, is a matter of careful engineering, followed by the painstaking tests that I have mentioned.

The man, who will carry out this arduous mission, also has to be chosen with the utmost regard for the novel circumstances in which he will find himself -- circumstances totally new in man's experience, of a kind never before encountered by a traveler on Earth. He must be thoroughly trained, in every way that we can devise, so that he will recognize the conditions, face them without confusion or delay, and take whatever action may be appropriate to make the flight a success.

Just as we began the process of developing the capsule by defining the specifications which it would have to meet, so in selecting candidates to ride it into orbit, we started by defining the qualifications which the man must have. These requirements were drawn up by the Aeromedical Committee of NASA, in consultation with flight surgeons of the Armed Forces and other eminent authorities on human reactions in space flight.

They determined that the Mercury astronaut should be a military test pilot, not more than 40 years of age, at most 5 feet 11 inches tall, and in superb physical and mental condition. He should also be a university graduate, with a degree in engineering or the physical sciences. This qualification was laid down for several reasons, one of which is that the astronaut's primary duty will be to judge the performance of the craft in flight, and to gather and interpret scientific data on the whole environment of space.

Our medical consultants then screened the records of all the pilots graduated in recent years by the test-pilot schools of the Navy and the Air Force. We found 110 men who had all these qualifications. That there are so many is itself a tribute to the technological training in today's Armed Forces, where skill in science and engineering has become increasingly essential to the operation of military weapon systems.

For the past month, these pilots have been visiting Washington, in groups of about 30, to attend briefings on every aspect of NASA's plans for Project Mercury. From these groups, after they become entirely familiar with the program, volunteers will be invited to apply for the full course of training. The 36 most highly motivated and best qualified volunteers will be accepted as candidates.

They will be given searching physiological and psychological tests, to learn how they would meet the unusual stresses which are expected in orbital flight. By the end of March, our medical advisers will have selected a dozen men, who seem best fitted for the exploit which they will hope to undertake. Those pilots will constitute the Mercury team. We have no way of knowing, at this time, who they will be. But their names will become familiar to all of you, within the next few months.

They will receive the most intensive course of training ever offered to a party of prospective explorers. Every conceivable characteristics of space flight, that can be simulated on the ground or in the air, will be made a part of their personal experience. Every detail of the launching, guidance, and tracking procedures will be taught them by ground crews, until they know the operation as we know the working of an office in which we have spent the better part of our professional lives.

All this training of the selected pilots, and all this repeated testing of the rocket and its component parts, are directed toward one end: that the first orbital flight of the Mercury vehicle shall be as nearly routine as human ingenuity and practice can make it. We are determined that the risks to the pilot will be no greater than those experienced during the first flights of a new, high-performance airplane. Those are calculated risks, which test pilots have chosen deliberately, for the sake of the rewards in knowledge and pride of achievement.

There are other nations -- and I hardly need to name an outstanding example -- where human life is held in less regard than we have for it, here in the United States. Such a nation, armed with rockets of great power, might very well manage to put a man in space before we do. With less care than we take, to guard against all possible hazards, a manned satellite could be established much sooner. The passenger might return safely -- or he might not.

We cannot absolutely guarantee that our man, either, will come back unharmed. There are dangers inherent in every experimental flight -- every voyage of exploration -- every pioneering venture. But because we believe in the sanctity of human kind, we intend to surround this particular experiment with every conceivable precaution. If our consideration for the pilot's safety should cost us the prestige of being first to send a man into orbit, so be it. Our primary purpose is not the prestige, but the new knowledge of space that this man is expected to bring back to us.

Instrumented rockets have their uses -- very valuable uses -- in providing us with data on conditions in space, their extent, and the most practical methods of dealing with them. An instrumented rocket is like the dove that Noah sent to learn whether the waters had subsided. It reports on the climate in space and helps to refine our techniques of celestial flight and communication.

But no instrument has the powers of intelligent observation, judgment, and decision that are bred into a human being by all the long millenia of his evolution. If only because man is the most highly organized piece of research apparatus, we would have eventually to put a trained observer into orbit. More than that, as I indicated earlier, the ultimate object of this endeavor is to extend not only our knowledge, but our reach as well -- our room for action and maneuver, our mastery over the forces of nature.

It is inevitable that we open highways into the wilderness of space, as we opened them a century ago through the wilderness to California. The age of man's boldest adventure, his most ambitious advance into the unknown, is upon us. The question no longer is whether we wish to explore the universe, or whether we have the resources and the will to do it. The only question now is how soon we begin this exploration -- whether, as a nation, we are ready to assume our full share of humanity's greatest enterprise.

The Mercury capsule will be occupied by only one man, of the 12 we are training. He will be the one who, in the opinion of the flight surgeons, is at the peak of physical and psychological readiness, on the day of launching.

He will be followed by others. In due course a permanent manned satellite will be placed in orbit around the Earth, to conduct research, as a navigational guide, and possibly as a station from which to organize deeper penetrations into space. As we master the required technology we will send an expedition to the Moon, and later on to Mars, to Venus, and to more distant reaches of the Solar System.

If we find other planets inhospitable, we might conceivably establish worlds of our own -- inhabited spheres, far out in space, orbiting around the Sun rather than the Earth or Moon. But these are possibilities of a distant tomorrow. Our immediate aim is to establish man in space -- to give him a bridge head, so to speak, from which he can study the terrain, and then push on to more remote objectives.

None of us knows what the final destiny of man may be, or if there is any end to his capacity for growth and adaptation. Wherever this venture leads us, I am convinced that the power to leave the Earth -- to travel where we will in space -- and to return at our pleasure -- marks the opening of a new stage in man's evolution.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

PRESENTATION TO THE AVIATION WRITERS ASSOCIATION
NATIONAL PRESS CLUB, WASHINGTON, D. C.
by
T. Keith Glennan, Administrator
National Aeronautics and Space Administration
March 5, 1959

October 1, last, five months and five days ago, the National Aeronautics and Space Administration became an operating agency of the Federal Government. The nine weeks preceding, counting from July 29 when President Eisenhower signed the legislation which established NASA, had been used in recruiting the staff and in performing the many tasks essential to getting underway.

To provide us with many of the resources we would need -- the men, the facilities and the money -- there were transferred to NASA the 43-year-old National Advisory Committee for Aeronautics, with its 8000 people and fine laboratory facilities, the Jet Propulsion Laboratory -- including some 2300 people -- operated by the California Institute of Technology, the Vanguard program and with it, the fine group headed by Dr. John P. Hagen, the Pioneer space probe program which the Air Force and the Army were conducting under the direction of the Advanced Research Projects Agency, three satellite projects, and a number of ARPA and Air Force engine development programs.

To sum up, by the end of 1958, NASA had vigorous, rapidly moving although somewhat ad-hoc programs of space technology, space science, and space exploration. The total funding available to NASA for fiscal 1959 was $335,719,532. We have since asked for $48,354,000 in supplemental funds for fiscal '59 to permit acceleration of Project Mercury, the manned orbital space flight program, and to finance certain necessary construction and equipment items.

One of the most urgent tasks we faced when we began operations last October was to plan for the longer pull, as distinguished from the more immediate, more obvious projects that could be promptly programmed or were already underway.

I want to speak briefly about our long-range planning, and in this connection, to consider two problems that are of concern to you, to me, and in fact, to all Americans. The first of these problems, simply stated, is how much should the NASA be talking about what it hopes to do in the future.

You are generally familiar, I believe, with the language of the Space Act, relating to information, but to be specific, I quote: "The Administration (NASA) in order to carry out the purpose of this Act, shall ... provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof ---" and "Information obtained or developed by the Administrator in the performance of his functions under this Act shall be made available for public inspection, except (A) information authorized or required by Federal Statute to be withheld, and (B) information classified to protect the national security: Provided, that nothing in this Act shall authorize the withholding of information by the Administrator from the duly authorized committees of the Congress."

The way I read this language is that we are enjoined to report fully and candidly about what we have done, and about what we are doing. As I see it, we are supposed to talk as freely about our failures as we do about our successes. Having opposed unnecessary and excessive secrecy in the conduct of scientific investigations by governmental agencies for many years, I find myself in complete agreement with this provision in The Space Act.

The American public, the people who will have to pay the costs of our space programs, most certainly are entitled to full disclosure about the way we are accomplishing our vital, assigned missions. Further, science will flourish best when interchange -- free interchange -- of information between scientists is encouraged.

Now, there is another aspect to this matter of reporting to the American public about our activities, and that is what we should do about discussing futures -- what we plan to do, and what we hope to do. Here again, it is obvious to me that we cannot expect the Congress, representing the taxpayer, to appropriate hundreds of millions of dollars to NASA unless and until it has become convinced of the soundness of our planning and the need for the space programs we propose.

To do this -- to give the Congressional Committees solid evidence of the validity of our requests for funds -- requires that we present a strong case for the future activities of the agency. In the research and development business, there is an old saying that if you know how an experiment is going to turn out, it no longer is justified as an experiment. Thus we find ourselves selling the need for expenditures against the reality that we don't know exactly how to go about each element of the task ahead. And we find it necessary to set dates and suggest the end results to be obtained even though we may be uncertain about the precise methods we shall have to use to assure accomplishment. More often than not, those dates rise up to haunt us for it is characteristic of people working in exploratory activities to be optimistic about their abilities to meet schedules.

In passing, I believe I should observe that you, who have the vital role of providing the citizens of the United States and, in fact, the entire world with prompt, accurate reports about what is happening in the realm of flight, are not in agreement as a group, on the course we should chart in this area of discussing futures.

By way of example, I recall the general criticisms directed our way late last fall and early this year when it was widely reported that we had no long-range plans. The fact that we were very, very much absorbed with performing work of great immediate importance -- work that, incidentally, had to be done before we could tackle "futures" -- apparently was far less exciting and newsworthy than reports that we didn't know what we ought to be doing in the years ahead.

Hardly five weeks ago, I outlined the procedures we were using to select volunteers for our first manned, orbital space flight program, Project Mercury. You will recall, the schedule: First, presentation to about 110 potential candidates of details of the program, after which the call for volunteers-- and you should know that nearly 80 per cent of those to whom we talked volunteered --; second, selection from these volunteers of a group of approximately 30 for further tests -- and finally, choice of a small group of these men who were found to be best qualified. In this instance, the criticisms were divided. We were subjected to heavy pressures from some editorial quarters because we declined to make public the names of the 110 "potentials" or of those volunteering. (The reason: The psychological and physical evaluations leading to the final selections are a private, privileged matter between the examining aero-medical specialists and the volunteers.) Elsewhere, we were lampooned as blue-sky merchants because we had talked about the pilot selection process before the space capsules had even been built.

Getting back to the business of long-range planning, we have been working very hard to map out with some precision the routes we intend to follow in our journeys into space. A first step in this direction was the blue-printing of our programs for fiscal 1960. We took the position that these plans should be directed to the appropriate Congressional committees before they were broadcast to the general public by press, radio, and T.V.

I am sure I am not overstating the case when I observe that this decision was not altogether pleasing to all members of the Fourth Estate. Even so, we were somewhat surprised to note fairly sharply worded editorial comment, that instead of talking about our plans for the future, we would be serving to better effect the national interest if we stuck to our allotted task of sending more and better probes and satellites into space.

I could go on, with other instances where our discreet silence or our modestly phrased forecasts of future goals have aroused editorial umbrage, but I expect I have made my point: - We're damned if we do, and we're damned if we don't. I am reminded, somewhat ruefully, of the old saying, that the man who walks in the middle of the road is the one most likely to be run over by the steam roller.

On the other hand, having admitted to being human in this matter of occasional bewilderment when the editorial shot and shell seem to be coming from every direction, I sincerely mean it when I say that responsible comment -- public comment -- is a necessary ingredient in our business. This exciting, expensive space business we're doing is only one small segment of the total activity of the Federal Government, and yet it is one about which it is vital that the American public shall be promptly and fully informed.

I say, fully informed, because not only is it essential that the American public know they are getting an honest dollar's worth of performance for every dollar of their taxes appropriated to this business, but it is at least equally important that our citizenry become aware of how necessary it is for them to support our national efforts to pioneer in space. And, by support, I mean much more than mere acceptance of tax levies; I mean no less, the unstinting contributions of talent that will be required from so many. And over the long pull, it is important that a larger proportion of our citizens gain an appreciation of the importance of the support -- the generous support -- by the Government of basic research in a variety of fields.

The second of the problems I want to discuss is how to inform the American people about our national progress in space in such fashion as to insure that they won't, on the one hand, become discouraged and adopt the belief that we are hopelessly behind the Russians and on the other, and even more erroneously and dangerously, become confident that a couple of recent successes have demonstrated our pre-eminence in space matters. In the same manner in which I have urged that our space program be planned and operated on a sensible and continuing level of effort, it is important that we realize that this is a long-range program, full of uncertanties -- one demanding sustained effort and support over a great many years.

That we started later than the Russians to build the vehicles that would be needed to send first instruments and then man himself into space is a matter of historic record. That the Russians today possess rocket engine systems more powerful than the biggest in our inventory, and consequently, that for some time to come they will be able to loft into space payloads substantially larger than ours are, again, facts of life that must be accepted.

Earlier this week, I had to be in Boston. During this brief journey, I was repeatedly asked by responsible citizens if the successful Vanguard II and Pioneer IV launchings weren't, indeed, proof that we had "caught up with the Russians." It wasn't pleasant for me to have to reply that, no, these U.S. space efforts didn't mean we had drawn even with the Soviet space workers. Of course, we were tremendously proud of the February 17 vindication of the basic validity of the Vanguard project that NASA had inherited from the Naval Research Laboratory. And we are, equally happy about the March 3 performance of Pioneer IV, the solar-orbiting payload that had been put into space by NASA's Jet Propulsion Laboratory and the Army Ballistic Missile Agency. But the fact remains, that for months to come, we must count the weights of our space payloads in tens of pounds, while the Russians count theirs in the hundreds of pounds. It is not at all clear that this single criterion of weight is the most important one -- but it is one measure of our capability to engage in more complex experiments in the future. Hence it is impossible, indeed, it is unwise to console ourselves with the knowledge that published information about outer space phenomena show that this country has been doing very well in acquiring that information.

We are, as has been duly reported, working very hard to develop the large, reliable rocket engines required by our future space projects. At the same time, we are developing -- on a national basis -- the other requisites for our rapid, orderly progress into space.

To excel in space technology, space science, and space exploration means that, for years to come, we in the United States must be prepared to invest -- and in substantially large amounts -- talent, treasure, and time. This, I submit, is a story that demands telling; upon our determination to commit ourselves in matters of this kind depends our survival as the leader of the free world.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 7827

FOR RELEASE:
P.M., March 9, 1959

SCIENTISTS STUDYING DATA FROM VANGUARD II

A wobbling action of Vanguard II -- similar to the wobble in a football forward pass when it does not have precisely the right spiral spin -- is making it unexpectedly difficult to interpret cloud-cover data the satellite has transmitted for about 18 days.

Thus, the job of decoding the signals from the satellite has become something of a detective story.

The satellite, launched from Cape Canaveral, Florida, February 17, 1959, stopped transmitting information on the earth's cloud-cover at 9:37 p.m., EST, Saturday, March 7, when its batteries expired. The transmitter batteries operated about four days beyond their programmed life of two weeks. The 30-inch satellite is expected to remain in orbit at least 10 years.

Scientists at the U. S. Army Signal Corps Center, Fort Monmouth, N. J., who designed the cloud-cover experiment have plenty of clues to go on because Vanguard II's electronics system performed well; the signals were strong and sharp. In all, they have a quarter of a million feet of taped signals to work with.

At the earliest, it will take weeks -- perhaps months -- to produce a picture of part of the earth's cloud-cover, one of the objectives of the experiment.

To accomplish this, the scientists must plot precisely the exact extent of the satellite's wobble. And this is what they're working on now.

Otherwise the satellite is performing up to -- and, in some instances, even beyond -- expectations. Electrically, it was an unqualified success.

In 211 trips around the earth, as of 9:37 p.m., March 7, it had been interrogated successfully 152 times by earth stations. (During 19 of its orbits, the satellite did not pass within range of any of the interrogation stations.) The tape recorder, which stored up about 50 minutes of data and then transmitted it on command in one 60-second burst, worked perfectly.

As planned, a solar switch turned off the satellite on the shadow side of the earth and back on when it was around on the sunlight side. The signals showed light intensity corresponding to the bright and dark areas of the earth.

Also, the thermal design of the satellite has been proved. It was designed to have a temperature of 110 degrees F. when spending about 68 per cent of its time in sunlight. During its first 18 days of orbital flight, the temperature was within one degree of this design value.

The wobbling (called "precessing" by the scientists), which made the signals hard to plot, is traceable to the spin regulation mechanism of the satellite. Resolution of this spin problem alone will be a contribution of great value to future weather satellites.

To determine the wobble angle, technicians at Fort Monmouth, Fort Stewart, and Blossom Point, took precise radio measurements of the satellite as it moved across the horizon.

As a first and limited effort to explore the use of satellites for meteorological studies, Vanguard II has performed a very useful purpose.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 7827

For Release: AM's Wednesday
March 11, 1959

NASA ANNOUNCES RESEARCH APPOINTMENTS PROGRAM

A program of research appointments in theoretical and experimental physics associated with exploration of space was announced today by the National Aeronautics and Space Administration and the National Academy of Sciences-National Research Council.

The program is expected to play an important role in stimulating basic research in the space sciences. As administering agency, National Academy of Sciences-National Research Council will receive an initial grant of $350,000 from NASA.

The program includes Research Associateships at the postdoctoral level with stipends beginning at $8,000 a year. In addition, Senior Research Associateships with increased stipends will be available for experienced scientists with substantial records of accomplishment. These appointments are intended for scientists of exceptional creative ability who wish to free themselves from academic responsibilities in order to devote an extended period to basic research.

Applications should be received by April 30, 1959. Requests for applications and further information should be addressed to Fellowship Office, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D.C.

NASA will provide the facilities and staff required for research by the appointees at one of its space centers. Theoretical research will be supervised by Robert Jastrow, Chief of the Theoretical Division of the NASA Space Center. Experimental research will be under John W. Townsend, Jr., Chief of the Space Sciences Division. It is expected that later appointees will take part in additional activities in NASA.

The program covers research in the following areas:

THEORETICAL RESEARCH

PHYSICS OF PLANETS AND SATELLITES: Celestial mechanics; geodesy; planetary interiors; lunar and planetary surfaces; planetary atmospheres; ionospheric physics; atomic and electronic interactions.

ASTROPHYSICS: Solar and stellar atmospheres; stellar interiors; cosmology; relativity.

PLASMA PHYSICS: Magnetohydrodynamics; magnetic fields in space; particle populations in space; cosmic rays.

EXPERIMENTAL RESEARCH

FIELDS AND PARTICLES: Measurements on gravitational, magnetic and electric fields; ionospheres of the earth and other planets; energetic particles.

PLANETARY ATMOSPHERES: Pressure, temperature, density and composition distributions in the earth's atmosphere; atmospheres of the other planets, the moon, and the sun; the study of meteors.

ASTRONOMY: Interstellar and intergalactic media; stellar structure; study of the air glow in the earth's atmosphere; development of new astronomical instruments for use on rockets, satellites and space probes.

SOLAR PHYSICS: Solar-terrestrial relationships, and measurements in the ultra-violet and X-ray regions of the spectrum.

METEOROLOGY: Satellite and synoptic rocket-sonde studies.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

CORRECTION: PROJECT SCOUT RELEASE FOR USE MARCH 11

The last line of page one of the Project Scout release, for use March 11, failed to print. It now reads: "have been let. They include: (top of page two) Polaris motor."

It should read: "have been let. They include: (graf) First Stage: Aerojet Senior, a modification of an early (top of page two) Polaris motor."

\- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Ex 3-3260
Ext. 7827

For Immediate Release
March 11, 1959

PROJECT SCOUT

Project Scout, a low cost, four-stage solid propellant test vehicle, is being developed for a wide range of aerodynamic and space experiments.

Cooperative development plans for the 35,000-pound, 70-foot vehicle -- to be ready for initial tests by mid-1960 -- were worked out by Dr. Hugh L. Dryden, NASA Deputy Administrator, and General Thomas D. White, Air Force Chief of Staff.

NASA plans for Scout, dubbed the "poor man's rocket" due to its relative low cost, include orbital and high-altitude shots as well as high-velocity re-entry tests. AF plans for the vehicle call for inertial guidance and aerodynamic tests. The AF has no orbital plans for Scout.

A Scout vehicle will cost in the neighborhood of $500,000 -- substantially less than other test vehicles its size and capability. Scout, for example, will be capable of putting a 150-pound payload in a nominal 300-mile orbit. In high-altitude shots, it would send a 100-pound instrument pack some 5,000 miles high.

Under the Air Force-NASA agreement, NASA is doing the basic development on Scout and will provide the AF with copies of its specifications. An AF contractor then will design modifications required for AF experiments. A joint team has been set up to coordinate the project.

Most of the contracts on the basic vehicle, which will be put together at NASA's Langley Research Center, Langley Field, Va., have been let. They include:

First Stage: Aerojet Senior, a modification of an early

Polaris motor.

Second stage: An improved Sergeant by Thiokol, Inc.

Third stage: A new rocket being developed by Allegheny Ballistics Laboratory which will be a scale-up of the Vanguard third stage.

Fourth stage: By ABL, same as the third stage of Vanguard.

Minneapolis-Honeywell Regulator Co. will provide a simplified gyro guidance system and spin stabilization equipment for NASA experiments. Still to be let is a contract to the firm responsible for joining the components at Langley Research Center and developing the launcher structure.

Initial test firings will be from NASA's Wallops Island (Va.) Test Station but eventually Scout will be shot from a number of launch sites. The solid propellants will simplify the launching procedure and eliminate much of the countdown and launch facilities needed to shoot liquid-fueled vehicles.

The AF will make modifications of the basic NASA vehicle for its tests. For instance, the fourth stage in the basic vehicle will be spun to prevent it from tumbling in NASA experiments. AF plans, however, call for tests of inertial guidance components and aerodynamic tests of advanced configuration models. For these tests, the payload package must be stable about all three aixes and controllable in response to guidance signals. After basic development, the AF and NASA can choose a vehicle with or without spin stabilization, depending upon the requirements of the test at hand.

The AF portion of Scout development is identified as System 609A, formerly nicknamed "BRATS" (for Ballistic Research and Test Systems) and BMTS (Ballistic Missile Test Systems). Air Force management for its part in the project has been assigned to the Air Force Ballistic Missile Division at Inglewood, Calif. An AF prime contractor will be responsible for supplying AF-specified guidance and control, system modification, integration, ground handling equipment and support during test firings.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Statement of
T. Keith Glennan, Administrator
National Aeronautics and Space Administration
before the
Military Operations Subcommittee
of the
Committee on Government Operations,
U.S. House of Representatives
March 13, 1959

We were pleased to be invited here today before your Subcommittee which has been looking into the management and operation of the military ballistic missile program. I understand that you are interested in NASA's relations with the Department of Defense in the operation of our national space program.

During the past 18 months, we in the United States have made an intense, candid re-appraisal of where we stand in the world of science, and more particularly, where we stand in space technology. Today, I want to review quickly some of the events of this period, during which President Eisenhower and the Congress moved quickly to strengthen our national posture in these areas.

One of the first actions by the President was to appoint James R. Killian, Jr., President of Massachusetts Institute of Technology, as his Special Assistant for Science and Technology, and to direct him to make recommendations for whatever action was necessary. In both the House and Senate, special committees studied the question of what our nation should be doing in space matters.

The nation's programs of space experiments were accelerated. In addition to the Vanguard-IGY program, carried out by the Navy under NSF funding the Army undertook a series of Explorer satellite launchings, and, a little later, the President authorized the Air Force and the Army to send instrumented probes towards the Moon.

The Advanced Research Projects Agency was established within the Department of Defense to give technical direction to military space activities and other areas of advanced research. In addition, ARPA was given responsibility for technical direction of civilian space activities until such time as the necessary new organization had been completed to assume that responsibility.

As you know, the President sent a special message to the Congress in March of last year, calling for establishment of the National Aeronautics and Space Administration. Perhaps the most significant single aspect of the National Aeronautics and Space Act of 1958 is contained in one sentence, and I quote: "It is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." Here was recognition that the ceaseless struggle against communism is by no means exclusively military.

The Space Act was passed in July and the President signed it on the 29th of that month. He appointed me on August 8, and, after confirmation by the Senate, I was sworn in on August 19. By October 1, we were sufficiently organized to say we were "open for business."

One big reason we could become operational within a matter of weeks, was that the NASA is built upon the structure of the National Advisory Committee for Aeronautics ... which from 1915 when it was established by the Congress until October 1 of last year was the nation's principal aeronautical research agency. From NACA we inherited nearly 8,000 hard-working, talented people, $350,000,000 in research facilities; and well-planned research programs already underway.

When NACA was established, two years before our entry in World War I, it had become obvious that in the years since the first flights of the Wright brothers in 1903, the United States had fallen far behind Europe in airplane development. Over the following years, NACA became internationally respected as the well-spring for much of the world's knowledge about the problems of flight, and its efforts were widely credited with American reassertion of leadership in aeronautics. Its scientists and engineers were recognized for their exceptional competence, especially in aerodynamics, structures, and propulsion. Its laboratories, now called research centers, are located at Langley Field, Virginia; Moffett Field, California, and Cleveland, Ohio. Also, there are the High Speed Flight Station at Edwards Air Force Base, California, and the rocket launching facility at Wallops Island, Virginia.

With this fine base for the development of our operating organization, we were able to accept almost immediately from the Department of Defense of several projects being carried out by the Army, the Navy, and the Air Force. Among these were Project Vanguard, the single chamber, 1-1½ million pound thrust engine which the Air Force had supported through a study contract with North American Aviation, several rocket engine developments intended for use with high energy fuels, and the remaining space probe activities of the Army and the Air Force.

Early in October we formed our basic organizational structure, creating a major new division expressly responsible for space flight development activities to complement our activities in aeronautical space research. We also undertook the planning of a comprehensive, national space program, at the direction of the President. The urgency of the situation did not permit us the luxury of delaying this vital latter task until we had fully worked out our organizational problems.

It was apparent, of course, that performance of a bold, vigorous national space program would require a rapid build-up of NASA with particular emphasis on the prompt acquisition of those talents necessary to the design and fabrication of space vehicle systems, the development of payload packages, and the development and operation of adequate tracking and data acquisition facilities. This led to an analysis of the various groups which had been contributing to existing space projects in any significant way, with the idea of requesting that suitable facilities be transferred to NASA. Such transfers were contemplated by the Congress as was clearly expressed in the legislative history and finally in the Space Act itself.

Out of these studies came the actions which were consummated in the Presidential Executive Order of December 3, 1958. Under that order NASA entered an agreement with the Department of the Army whereby its Ballistic Missile Agency (ABMA) at Huntsville, Alabama, will work on certain NASA projects. At the same time, the Executive Order transferred the functions and facilities of the Jet Propuslion Laboratory at Pasadena, California, from the Army to NASA.

With acquisition of this government-owned laboratory which is operated by the California Institute of Technology, NASA gained a team of 2,300 scientists and engineers with a high order of competence in electronics, guidance, propulsion, systems analysis, tracking and telemetering.

Somewhat earlier, we had obtained more than 200 scientists and engineers from the Naval Research Laboratory. These very able people include the Vanguard Project team and another group that possesses unique competence in upper atmosphere research.

By the end of June of this year, NASA will employ 9,000 persons exclusive of the JPL staff. The fiscal 1960 budget provides for a further increase of 1,000 employees. Beyond that, I wouldn't want to predict, but I do feel very strongly that we should keep our in-house establishment as small as we can, consonant with our ability to do the job we have to do. An important segment of that job is the ability to provide the technical supervision and management of substantial development programs in this very complex and difficult new field.

Turning to other details of the Space Act and the national space program, the legislation states that NASA's principal mission is to direct all U. S. aeronautics and space research and development except for activities peculiar to or primarily associated with weapons systems, military operations, or the defense of the United States. These latter are to be the responsibility of the Department of Defense.

A most important duty placed on the President by the Space Act is to develop "a comprehensive program of aeronautical and space activities to be conducted by agencies of the United States." Preparation of such a program for ultimate approval by the President has been delegated by him to NASA with the assistance and cooperation of the Department of Defense. Very substantial progress has been made in developing national space programs ... the national booster program ... the national tracking and communications program ... the national space sciences programs ... These are the basic elements to which have been given highest priority in structuring our total national space plan.

To advise him on planning and other matters, the Congress provided for the appointment, by the President, of the National Aeronautics and Space Council with the following membership: The President, chairman; The Secretary of State, the Secretary of Defense, the chairman of the Atomic Energy Commission, the Administrator of NASA, another person from Government -- this year, the director of the National Science

Foundation, and three members from private life, eminent in the fields of science, engineering, technology, education, administration, or public affairs. Each of the public members must be confirmed by the Senate.

The Act provides among other things that the Space Council will advise the President on the allocation of responsibility for particular activities to NASA and the Department of Defense. One further evidence of Congressional interest in maintaining a flow of information and increasing collaboration between the civilian and military programs was the establishment of a Civilian-Military Liaison Committee. As presently constituted, in addition to the chairman -- William M. Holaday -- there are four members of this Committee representing the military -- one from each of the services and one from the office of the Secretary of Defense -- and four members representing NASA.

It is well to remember that this space business is in its infancy. We have very little of the fundamental information necessary to the undertaking, with assurance, of many of the systems about which there has been much talk and speculation. Operational systems of interest both to the military and to civilian groups need much exploratory research and development work before we can be sure of their usefulness or effectiveness.

This brings me to discussion of one of the assets of great value that NASA gained October 1 in the transfer of, and I quote, "all functions, powers, duties, and obligations, and all real and personal property, personnel (other than members of the Committee), funds, and records" of NACA. This asset was the proven ability developed over 43 years to work, cooperatively and effectively, with the Military Services. Just because a prime mission of NASA is to venture into the unknowns of interplanetary space is no reason why this essential partnership arrangement should change. To the contrary, we at NASA and, I am also sure, the Military Services, are striving diligently to preserve and extend that cooperation.

As a matter of fact, the importance of this mutually helpful relationship was recognized in the drafting of the Space Act which states that aeronautical and space activities of the U. S. shall be conducted so as to contribute materially to, and I quote, "making available (by NASA) to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control non-military aeronautical and space activities, of information as to discoveries which have value or significance to that agency."

It is important to emphasize that, with the same vigor and determination with which we are prosecuting our urgent space programs, NASA's research centers continue, hard at work on problems affecting all of the nation's major intermediate and intercontinental ballistic missiles...as well as anti-missile systems under development. Most details of these research efforts are classified, but I can sketch in broad outline some of the problems without linking them to specific missiles. To mention a few:

...Warhead (nose cone) heating.

...Warhead stability.

...Stage spearation malfunctions.

...Overheating of the rocket's base.

...Wind-induced oscillations.

...Structual strength and lightness

...New, high energy fuels.

Mr. Chairman, we have been working hard, programming and accelerating our operations on the one hand, and staffing and perfecting our organization on the other. Sometimes, especially at the end of a long day, we get impatient because we are not able to do more and accomplish it faster. Then, we take a little time out, to assess what really has happened, in preparation for a report presentation to a Committee with concerns such as yours. A very great deal has been done even though we have been in business less than six months. As for the future, we know what we must do and we know that only the nation's very best will be enough to get it done.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Ex 3-3260
Ext. 7827

For Immediate Release
March 17, 1959

VANGUARD II NOW SILENT

The batteries powering the tracking transmitter in the Vanguard II cloud-cover satellite have finally played out -- a week beyond their programmed life.

The 20-inch satellite was last heard from at Antofagasta, Chile, tracking station at 9:51 a.m. EST Sunday (March 15).

Unlike Vanguard I -- which is one year old today -- Vanguard II does not contain solar batteries. Vanguard I, the tiny grapefruit-sized satellite operating on sun power, is still beeping its tracking signal. Racing around the earth every two hours and 14 minutes, Vanguard I has logged 131,318,211 miles since it was launched March 17, 1958.

Meanwhile, Army Signal Corps scientists at Fort Monmouth, N.J., are still working with Vanguard II weather data in an effort to come up with a map showing earth storm fronts.

The batteries which powered the weather data transmitter ran 18 days or four days longer than expected while the tracking batteries lasted 27 days -- seven days more than planned.

Vanguard II, which has covered 10,022,000 miles, has an apogee of 2,061 miles and a perigee of 350 miles. It is taking 126 minutes to circle the earth. Its older but smaller sister has an apogee of 2,452 miles and a perigee of 407 miles. Both are expected to remain aloft several hundred years.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

HOLD FOR RELEASE
UNTIL: 9:00 P.M. EST
Thursday, Mar. 19, 1959

Statement by

T. Keith Glennan, Administrator

National Aeronautics and Space Administration

before the

Electronics Industries Association

Washington, D.C.

March 19, 1959

If I were to claim affiliation with any one industrial group, I suppose by virtue of my formal education and early experience, I could claim to be an alumnus of the electronics industry. Like many of you, I started with the industry in its infancy and have watched it grow into a lusty giant. As I look out over this audience tonight, I am happy to see quite a few friends of many years standing who now are playing an important part in the management of some of your leading companies.

Since World War II, this era we live in has been called variously the atomic age, the age of automation, and now the space age. And playing a significant part in the development of each of them, we find the electronics industry. Important as have been your contributions in the past, it seems to me that you hold some of the trump cards in the fast moving game in which I now find myself engaged -- the space business.

I know the people in the electronics industry are vitally interested in knowing what role they will be playing, what contributions they will be asked to make, what requirements they will be asked to fill in this latest, most exciting of our "ages." I am going to address myself to these questions, but before I do, let me tell you something about the National Aeronautics and Space Administration.

Ours is an independent Government Agency, with full responsibility, under the direction of the President, for space research and operations of a scientific and technological nature which should lead to an increase in various fields of knowledge and to the application of that knowledge in the development of our society for the benefit of mankind. There is necessarily a close relationship between the work of our civilian agency and the space activities of the Defense Department. Obviously, space vehicles and the information gathering techniques that must be employed will be suitable both for scientific exploration for peaceful purposes and for military systems of various kinds -- just as aircraft can be suitable both for civilian air transportation and for military use.

According to the National Aeronautics and Space Act of 1958, "it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." The Act says that these activities are to be conducted by a civilian agency, which is NASA.

At the same time, the Act makes an important exception to this provision. It reserves the conduct of space activities having to do primarily with the development of weapons systems, with military operations, or with the defense of the Nation, to the Department of Defense. Provisions are made in the Act for close cooperation between NASA and the Department of Defense in the interests of avoiding unnecessary duplication and providing complete interchange of information between the two agencies. The Space Council, chaired by the President, and the Civilian-Military Liaison Committee are the formal mechanisms established to help accomplish this purpose. But the day-to-day contacts at every level are the most important continuing elements in insuring this collaboration.

The Space Act provided for the absorption by NASA of the personnel and facilities of the National Advisory Committee for Aeronautics -- some 8,000 scientists, engineers, and supporting personnel -- and the great laboratories, now known as Research Centers, at Langley Field in Virginia, Moffett Field in California, and in Cleveland, Ohio. Smaller, but very important activities, are the High Speed Flight Station at Edwards Air Force Base in California, and the rocket launching facility at Wallops Island on the Virginia Coast.

On the first of October 1958, we officially set up shop, absorbed the NACA and accepted the transfer of the

Vanguard project from the Naval Research Laboratory. Before the end of November, more than 160 able scientists had transferred to NASA from the Naval Research Laboratory, including the bulk of the Vanguard project personnel and some very fine scientists interested in upper atmosphere research.

On 3 December, the Jet Propulsion Laboratory in Pasadena, California, was transferred to NASA from the Army by a Presidential Executive Order. Operated by the California Institute of Technology under contract to NASA, this laboratory employs 2,300 people on a variety of projects. These include guidance and control systems, tracking, telemetry, the development of instrumented payload packages, and rocket propulsion. Thus, JPL, along with the Vanguard Group, are our principal centers for electronic research.

Excluding the personnel at JPL which I have previously noted as a contract operation, NASA expects to have about 9,000 employees by the end of June 1959. Our budget for the next fiscal year contemplates an increase of slightly more than 1,000 -- mainly scientists and engineers -- by June 1960. Our present plan is to keep NASA as small as we can, consistent with our ability to manage our programs in a purposeful and efficient manner. This means that a large part of our research and development activities will be carried out under agreements with other Government agencies, with scientific institutions, universities, and, most importantly, with private industry.

This policy represents a departure from the practice followed in the past by NACA. Our predecessor organization last year had a research and development program amounting to about $100,000,000, virtually all of it carried on in NACA's own laboratories. The 1959 budget for NASA, including a supplemental request which is now before the Congress, comes to some $385,000,000. Of this total, approximately $250,000,000 has been earmarked for contracts outside of our agency, most of it already committed.

The President's proposed budget for FY 1960 asks that $485,300,000 be granted to NASA. Of this amount, some $350,000,000 is intended for work to be performed by others -- again, principally industry.

Contracting with industry on a multi-million dollar scale requires us to seek the highest quality of American scientific and industrial skill, as well as the best capabilities of Government laboratories. We must draw on these outside resources, if we are to develop and produce the tools needed to establish our leadership in space research.

These tools include booster and upper-stage rockets of much greater size and thrust than any we now have; ultimately, entirely new generations of space vehicles must be developed and placed in use. Such vehicles must be provided with guidance and control mechanisms capable of much greater accuracy and reliability than those we now use. Tracking and data acquisition systems must be improved and many new stations installed in various parts of the world. Scientific experiments will increase in complexity with a resultant increase in the demand for more complex payload instrumentation. Capsules and cabins for manned space exploration in which astronauts can be sustained for days, weeks or months must be developed. As you look at this list -- and it is not, by any means, an exhaustive one -- you find one common denominator -- electronics.

NASA procurement policies incorporate, as a principal ingredient, the Armed Services Procurement Regulations. But there are some differences between our over-all procurement program and those of the Armed Forces. One of the most significant is the fact that we do not follow up our research and development contracts by entering into agreements for large-scale production. Each experiment in space is characterized by a high degree of attention to individual design and assembly. Even in a series of projects having the same general purpose -- such as the Pioneer space probes or the Explorer and Vanguard satellites -- the payload packages vary according to the data-gathering experiments planned. Stated simply, we are in the research and development business. Seldom, if ever, will any two of our flights be identical.

In another important respect, the contractual authority of NASA differs markedly from that of the Department of Defense.

This divergence is in the field of patent rights. The National Aeronautics and Space Act specifically requires that when inventions grow out of the work performed for NASA under contract, we must acquire the title to them for the Government. As you know, this is quite different from the procedure followed by the Department of Defense. Operating under no such statutory requirement, the Armed Forces normally confine their property interest in inventions to a royalty-free license.

I think it obvious that two such contrary patent policies, followed by Government agencies working in closely related fields of research and development, can be detrimental to the kind of cooperation that we must have from industry if our joint efforts are to go forward with effectiveness and urgency. We are quite aware of the attitude of industry -- your industry in particular -- on this matter.

On the other hand, you must realize that these rules are written into the law, and we cannot ignore them. The Administrator of NASA has authority to waive these patent rights, but only if he judges this action is clearly in the public interest. As an interim measure, we published recently in the Federal Register a statement of conditions under which requests for waivers of the patent clauses might be considered. As I think you know, NASA will hold public hearings on this matter of waivers in mid-May. In due course, I am sure, the Congress will want to review this entire matter. In the meantime, we are going to make every effort to administer the legal requirements in the patent field fairly and objectively, with due regard for the interests of both Government and industry.

Now that I have talked about my favorite subject, let me turn to yours, the electronic industry. In this space business, we depend upon you to make vital contributions to three major areas: design and fabrication of certain of our payloads; tracking, data acquisition and reduction; and guidance and control of booster rockets.

A specific example will illustrate how great is our dependence upon high-quality, special purpose electronic gear. A few minutes after midnight, the morning of March 3, our United States team of NASA, the Army and JPL launched from Cape Canaveral a deep space probe, Pioneer IV. Its conical payload weighed 13.4 pounds and measured 20 inches in length and 9 inches in diameter.

Within those limits of weight and size, there was packaged the following: two Geiger-Mueller tubes to measure radiation -- one of these was shielded with lead to cut out all but high energy radiation; a photo-electric sensor, shaped like a pistol, to test its effectiveness near the moon in activating picture-taking mechanisms in future space mechanisms; a de-spin mechanism, to slow down the spinning of the payload package so the above-mentioned sensor could perform its mission, and telemetry equipment.

The telemetry equipment included a battery-powered radio transmitter, with three sub-carriers, designed to transmit continuously on a frequency of 960.05 megacycles for about 90 hours, using 180 milli-watts of power. The transmitter had to telemeter information about radiation, about operation of the photo-electric sensor, (which, incidentally, didn't operate because it was set to work only after the probe got within about 20,000 miles of the moon. Actually, the closest approach was 37,000 miles). There was also a monitor device, incorporating a germanium diode, to report on the radio beacon's transmitted power at the source, and an independent arrangement whereby operation of the de-spin device was telemetered to the ground station.

I have gone into all this detail, because I think it important to emphasize our dependence upon good communications between our space payloads and data-receiving stations on earth. It has been widely reported that Pioneer IV continued to send back data until it had traveled more than 406,000 miles from the surface of the earth, the longest communications link in history. Since then, of course, it has continued its flight into orbit around the sun. I hope I may be forgiven if, in this connection, I note that the 406,000 miles was a distance approximately 32,000 miles greater than that announced by the Russians for their Lunik -- with an advertized payload of almost 800 pounds.

The useful life of Pioneer IV, however, lasted only as long as the transmitter's signals were received intelligibly on earth, and not one second longer.

Today, unfortunately, our rate of progress in exploring space is handicapped by our lack of an adequate payload capacity. Even with the exceptional efforts you and others have made to miniaturize experiments and the equipment to transmit data back to ground receiving equipment, there are very real limitations to the scope of the experiments we can mount upon the presently available launching vehicles. Essentially, we are limited to first-generation experiments for the next 12 months.

To remedy this situation, we are working with great determination and vigor to improve present systems and to develop larger boosters and upper stage rockets...in fact, complete vehicle systems...designed specifically for their space missions. Money spent now for propulsion systems development will make more certain and more economical the work we want to do in space in the years immediately ahead.

The ratio of weight between the launching vehicle of Pioneer IV and its payload was 10,000 to 1, and even when we begin using the launching systems of the Atlas class, the ratio will still be about a thousand to one. The new engine systems we will be using some years from now, will have a ratio between launching weight and payload of about 200 to 1, for interplanetary missions, and perhaps as low as 50 to 1, for satellite uses.

Today's payloads, on a per pound basis of useful instrumentation are enormously expensive. This is forcing us to perform our planning operations very carefully. Frankly, I think the program we have laid on for the next two or three years is more realistic and is really a better program from almost every point of view because of the need for this critical examination of both the technology and economics involved in maximizing the efficiency of use of payload packages during the period prior to the availability of more adequate propulsion systems.

As we press forward in our efforts to achieve more thrust and maximum reliability in these propulsion systems, we find ourselves smack up against another area in which we need very expert assistance. As I see it, we will be requiring very great contributions from the electronics industry to improve our means for guidance of space vehicle systems, not only for the "aiming" of them during the period of takeoff, but also, and perhaps more importantly, during the powered flight of the upper stages, "mid-course" guidance in the vernacular of the trade. When we begin sending space probes toward the planets, we are faced with the fact that we don't know precisely where these planets are, out in space. Right now, for example, we don't know where Venus is within 50,000 miles; this is the accuracy of our astronomical data. And we don't know yet how to gauge our vehicle velocity with the precision that is required. Assuming perfect initial guidance, an error of only one foot per second in launch velocity would result in a miss-distance from Venus -- if we knew where the planet was -- of 25,000 miles. The guidance and control problems are enormous; so are the contributions needed from men and organizations skilled in the art of electronic applications to these problems.

In the all-important effort to advance basic knowledge, it is of course impossible to predict the precise nature of what will be learned. But there are already visible ways in which we as a nation are bound to benefit from our space activities...in a dollars and cents way...and sooner than many would have imagined possible even a short time ago.

The two most frequently cited examples are the Vanguard II, the cloud cover satellite that sent back over a quarter of a million feet of taped signals. Although it was only a faltering first step on the road to development of a global weather forecasting system, Vanguard II was a very great accomplishment. The scientists and engineers involved now have a much clearer understanding of what must be done to develop a practicable system and we are planning the follow-on program with greater assurance than we had before that flight.

Communications satellites also offer great promise. The need for rapid and reliable global communications for the military is obvious; and studies have shown that there is bound to be a great increase in requirements for commercial global communications also. Independent analyses have predicted an increase in the total of overseas messages from the 1,500,000 level which existed in 1950 to 3,000,000 in 1960, and to 21,000,000 by 1970.

The use of satellites offers the possibility of solution to this growing problem of world communications. Using existing microwave techniques, a satellite system could be provided with almost unlimited bandwidth. Television, which requires the equivalent of 1,000 voice channels, would find great utility in this feature. There are several possible techniques for such use of satellites; they differ markedly in the complexity of the electronics carried in the satellite and in the size and extent of the ground-based equipment which will be required.

A technique we are going to explore will be a so-called passive system, with neither receiver nor transmitter being carried by the satellite. The transmitted energy can be beamed at the satellite, but the reflected energy will spread out in all directions, and because of this, very weak signals must be detected by the receiving antenna.

The requirements placed on ground station equipment in this system, of course, will be tough. High powered transmitters will be needed to send as much energy up to the satellite as is practicable. Low noise or very sensitive receivers to detect the very small amounts of power reflected from the sphere also will be needed. We will have to have large, steerable directional antennas to gather as much of the reflected power as possible, and computers to calculate the path of the satellite and point the antennas.

On the other hand, the passive communications satellite, because it carries no electronics, lends itself to multiple simultaneous party-line use. Also, because there are no frequency determinants in the satellite, the bandwidth or amount of intelligence carried would not be limited as it would be for some other systems.

We plan to launch a 100-foot-diameter sphere into orbit this fall to study this passive-communications technique. The sphere will be made of plastic with a vapor-deposited aluminum coating to provide a radiowave reflectivity of about 98%. At 1000 miles altitude, the sphere will be brighter than the North Star. In 1960, we expect to launch two more of these giant-size satellites which, incidentally, weigh 150 pounds, and communications will be established using the NASA-JPL antenna at Goldstone, Calif., and Bell Telephone Laboratory's equipment at Holmdale, N.J. It is our hope that additional industrial organizations may want to participate in these experiments.

Another system, perhaps farther off, would involve use of satellites carrying both a receiver and a transmitter. Signals beamed from the earth would be received and then immediately rebroadcast on another frequency. If the satellite can be placed in orbit at an altitude of about 22,000 miles, its speed will be such as to cause it to appear to be stationary in space with respect to a point on the earth's surface. Such a system would permit use of very large fixed antennas. But there are very difficult engineering problems to be solved. Among these will be the provision of means for precise positioning of the satellite in orbit, for attitude control and for supplying power to the receiver-transmitter over a long period of time.

Another area of interest to the electronics industry is data acquisition and computation. These past few weeks my associates and I have appeared before Congress to explain our need for a $48 million supplemental to the fiscal year 1959 appropriation. About $12 million of that sum will be used for increasing and improving our tracking facilities. Extension of the minitrack electronics tracking system by establishment of four new stations, located in Alaska, the northern part of the continental U.S., Newfoundland, and Northern Europe, together with installations of improved equipment at other stations,will cost $3,300,000. Installations of 85 foot radar dishes, similar to our Goldstone Station, in Australia and South Africa will enable the tracking of probes sent deep into space, $3,350,000 will permit initiation of the procurement of these units. The remaining $5,250,000 is for precision radar acquisition, tracking, communications, and associated systems, at a location in Southern Texas, for tracking mid-course re-entry and landing of the Project Mercury orbital capsules. Project Mercury is the name of our program aimed at placing a man into an orbit around earth and returning him safely.

As I mentioned before, Pioneer IV established a record communications link of over 400,000 miles. But that was a fairly short transmission link when we consider probes traveling far beyond the moon. That is why we are looking forward to the installations of MASERS and parametric amplifiers for use in connection with our big dishes. We must learn how to maintain communications up to 40 million miles in 1960 and to hundreds of millions of miles as soon thereafter as possible.

As for data handling, some experiments will require the transmission of raw data half way around the world from tracking stations to computation centers in the U.S. Other experiments may require the partial reduction of data at the receiving site before transmission.

In general, we will utilize data reduction centers in the U.S. to analyze the data and yield useable scientific information. We are well along in this respect. We have the Vanguard computing center here in Washington which will be expanded substantially in the next few years, another computing center at NASA-JPL in Pasadena, and we plan to use the Defense Department's Space Track installation at Cambridge and the computing center at the Space Technology Laboratories in Los Angeles.

To sum up, it has been my privilege to be associated with the development of a number of new fields of technology during the past 32 years -- first, the sound motion picture business, then the anti-submarine warfare game, then the atomic energy program and now the space business. Each of these has required the ingenuity, the services and the dynamic drive of this great industry of yours. Whatever the immediate task may be, your contributions will doubtless be just as applicable to the strengthening of military technology as they will be to the development of our greatest human resource -- knowledge. In this spirit of high adventure I look forward with you to the exciting days ahead. I do this with the fervent hope that our pursuit of the unknown in space may prove to be important mechanism for bringing men and nations together for peaceful collaboration and competition rather than as an added element in the cold war which is draining the world of energies that ought to be put to use for man's benefit everywhere.

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NASA RELEASE NO. 59-101

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 6327

HOLD FOR RELEASE:
A.M., March 20, 1959

NASA WILL FORMULATE SPACE SCIENCE WORKING GROUPS

The National Aeronautics and Space Administration plans to enlist the aid of a broad representation from the educational, industrial and scientific communities in carrying out its space sciences program, Dr. T. Keith Glennan, NASA Administrator, announced today.

Under Dr. Homer E. Newell, Jr., NASA's Assistant Director for Space Sciences, the program calls for the formation of a number of working groups -- one for each major project area -- to assure that programmed experiments are conducted rapidly and effectively.

Working group members will include scientists and engineers actively engaged in the research, development and testing, as well as NASA managers of specific projects. Working groups will receive projects following initial evaluation by Newell's staff to correlate scientific objectives with future satellite and space probe launchings.

Project areas in which working groups will be formed include: interplanetary observations; orbiting astronomical observatories; lunar and planetary surfaces; magnetic fields and plasmas, and ionospheres.

As needs indicate, Dr. Newell said, additional working groups will be established.

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NASA RELEASE NO. 59-102

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 7827

FOR RELEASE:
P.M., March 19, 1959

NASA CONTRACTS FOR FEBRUARY

NASA wrote $11,910,000 worth of research and development contracts during February.

Largest was a $10,500,000 contract with McDonnell Aircraft Company for Project Mercury -- the program to put man in space. Selection of McDonnell was announced earlier. Ultimately this project is expected to cost about $15,000,000.

Other February contracts were with:

Smithsonian Institution -- $470,000 for electronic tracking and data reduction equipment;

Aerojet General Corp. -- $170,000 for shipping rigs for Aerojet Senior boosters to be used in Project Scout, the four-stage all-solid propellant test vehicle to be ready in 1960;

Minneapolis-Honeywell Regulator Company -- $770,000 for the guidance system to be used in Project Scout.

-END-

NASA RELEASE NO. 59-103

Address of
Dr. T. Keith Glennan, Administrator
National Aeronautics and Space Administration
Colloquium at the
California Institute of Technology
Pasadena, California
March 20, 1959

The theme of this colloquium - The Realities of Space Exploration - seems to me to be a direct reflection of the often expressed philosophy of our distinguished colleague and host - Lee DuBridge. He reminds me somewhat of the gay blade who quipped to his girl friend as they sat down to dinner in one of the better restaurants in Los Angeles - "You know me - big hearted Otis - but read the prices first."

Just last week in Washington, speaking to an audience assembled by the organization known as Resources for the Future, Dr. DuBridge had this to say. "What is the connection between outer space and resources of the future? To tell you the truth, it seems pretty likely that for the next few years the exploration of outer space is likely to turn out to be one of our best methods of using up natural resources rather than conserving them or increasing them". Apparently he had heard of my recent testimony before one of the Congressional committees where I had predicted a billion dollar budget for space research in the near future. For he went on to say "Any budget item that amounts to a billion dollars a year is bound to be a real headache for the budget makers. And I predict they will ask some pointed questions about where all that money is going".

Having commented, somewhat skeptically, on the pie-in-the-sky proposals of some space enthusiasts, Dr. DuBridge then established his position thusly -- and I quote: "Let me hasten to make clear that I think a good sound program of space research, space exploration, and possibly space exploitation is worth a billion dollars a year to us -- possibly very much more than that. I favor a bold, imaginative and extensive program of space activities covering both military and civilian possibilities - including many reasearch ventures whose potential value, whether military or civilian, cannot possibly be foreseen. My only hope is that this program can be based on realities rather than on fancies." With this hope, Dr. DuBridge, I think the National Aeronautics and Space Administration can be said to be fully sympathetic.

I regret that I could not be present throughout this colloquium for what must have been a really exciting and stimulating series of papers on the results to date, the present programs and the possible future of scientific explorations in outer space. And I am willing to bet that not all of the speakers adhered scrupulously to the line that Dr. DuBridge and I would follow. That, gentlemen, is as it should be. Progress is made through a combination of provocative, often seemingly wild-eyed proposals and the efforts of those who have to deal with the realities of providing the means and the mechanisms for their accomplishment.

Since this latter responsibility is one in which I now have a part, it occurred to me that I might use this opportunity to tell you something about the realities of life in the Washington headquarters for space exploration. As I do this, I hope you will keep in mind that the first real man-made object to be propelled into space and into a satellite orbit was launched a little less than eighteen months ago.

With that admonition, let me give you a bird's eye view of the way in which an agency like the National Aeronautics and Space Administration is conceived, is born and begins to function in a field of endeavor that previously had been hardly touched by man.

It has been suggested to me that few people know how much and what type of effort is involved in getting underway an operation of the magnitude of the one we are attempting to carry on at NASA. I must confess that I had little understanding of these problems when I was sworn in on August 19, 1958. I saw the job then, and I see it now, as one which must be carried on with a sense of urgency similar to that which kept many of us at our desks and in the laboratories seven days a week during World War II. I saw it, too, as an activity somewhat unique in the sense that we were created as an agency whose principal purpose was to be the extension of man's knowledge through a program of research and development and exploration of the atmosphere and of space.

Looking at the situation realistically, my only regret was and is that the undertaking was established as a reaction to the activities and accomplishments of another country rather than to satisfy our own conviction that scientific inquiry and the application of the knowledge to be gained through research for the benefit of mankind is in and of itself an activity worthy of the determined support of the people of this great nation. Be that as it may, we are grateful for the opportunity to participate in this exciting adventure.

You will recall that it took some time, after Sputnik I, for the Administration and the Congress to determine what, exactly, were to be the purposes of our space exploration and the methods by which they might best be achieved. It then took additional time to decide what type of organization should be given the responsibility for the program to pass the necessary legislation for approval by the President. Thus it happened that the National Aeronautics and Space Act did not become law until the 29th of last July and that the resulting Agency - NASA - became an operating entity not quite six months ago.

Here let me digress for a moment to reflect on the significance of the law. As you know, the Act declares "it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." Separating these so-called civilian activities from research and development for military objectives, it reserves to the Department of Defense the conduct of space activities having to do primarily with the development of weapons systems, with military operations or with the defense of the nation. Speaking of realities, such a separation in the space field is difficult, if not almost impossible, as you well know. The Congress, with sober second thought, realized it, too, and provided mechanisms such as the Space Council and the Civilian-Military Liaison Committee to study possible jurisdictional conflicts and advise the President, who was given the final authority for allocation of responsibility for the conduct of specific projects. Provision is made, of course, for keeping the military departments aware of our activities, and they are expected to reciprocate. Speaking of realities again, it must be clear that unless very determined and sustained effort is made, such interchanges will tend to be less than complete under normal operating conditions. We are making a substantial effort to assure good interchange of information; we intend to continue that effort.

In addition to probable military applications, we have every right to expect that some of these activities in space will return to the nation economic benefits of great value - to quote the familiar examples, the prediction of weather conditions and the development of useful and economic methods for world wide communications systems.

But our main channel of effort - our basic purpose, as I see it - is the pursuit of knowledge, aside from man himself, our greatest human resource. The subsequent application of that knowledge to useful purposes - civilian or military -- is an activity in which we will play a significant part, as well, but only to the point where operational systems have been shown to be feasible or are identified by civilian or military agencies as meriting further development by them.

Now back to my narrative. Hugh Dryden and I were nominated by the President for the posts of Administrator and Deputy Administrator of NASA on the 8th of last August, just ten days after he had signed the bill into law. Sworn in on the 19th of the month, we set about the organization of this new agency. It was our good fortune that the Space Act provided for the absorption into NASA of the 43-year-old National Advisory Committee for Aeronautics together with all of its personnel, property, projects and funds. By this acquisition we were provided with a strong foundation on which to build our new organizational structure. NACA brought us a staff of nearly 8,000 highly trained scientists, engineers, and administrative people capable of contributing materially to almost any research program having to do with flight. As many of you know, there is hardly an area of research and design in the field of manned and unmanned flight that has not drawn heavily on studies made by NACA. Distinguished leadership had kept this great organization years ahead of the field in providing the fundamental information on which new developments in propulsion systems and airframes could be based. More than that, NACA people had a long record of happy and productive relationships, both with industry and with the military services.

It soon became clear to most interested parties, however, that a simple expansion of the efforts of the NACA people would not suffice to handle the new responsibilities of NASA. From what had been an essentially non-competitive existence, we were thrown immediately into a competitive situation with the military services. From an almost wholly self-contained research and development activity, somewhat removed from the political scene, we found ourselves faced with the necessity of protecting that precious research and development capability; while at the same time undertaking the organization of expensive and difficult projects involving the services of others and calling for the development and use of operational systems, such as Project Mercury and the rocket engines and vehicles, which would be needed in the near and long term future. The talents, equipment, and experience brought to us by NACA were welcome -- indeed essential. But we had to acquire, with the utmost dispatch, additional talents in fields of specialization not previously of interest to NACA, and we had to develop our abilities to live and accomplish the desired results in the climate of competition and pressure which prevails at many levels in Washington.

With the transfer from the Naval Research Laboratory to NASA of the Vanguard Project we acquired the services of more than 150 highly competent scientists and engineers possessing specialized experience in theoretical and experimental studies of the upper atmosphere and in the design and development of payload packages for satellite vehicles. Early in December, the Army transferred the Jet Propulsion Laboratory to NASA. This decision began what I fully expect to be a most effective and productive relationship with Cal Tech's highly respected laboratory staff, whose interests now center in the exploration of outer space and whose talents complement those of other elements of the NASA organization.

While all of these discussions and negotiations were proceeding, NASA people were getting their collective feet wet in the business of launching satellites and space probes as the result of the transfer of certain of these responsibilities to NASA from ARPA. And the recruitment of staff, both technical and administrative, was proceeding. Thus we were plunged overnight into full operation on several fronts. We had a current launching schedule, not of our own making, to maintain. We had a budget to prepare and less than two months in which to lay out the program we would have to support before the Bureau of the Budget and the Congress. And we were finding it necessary to respond to pressures from all sides to deliver, over night, long range plans, spectacular and immediate results, and provide statements that would satisfy the demands of people in industry and educational institutions who wanted word about our operating policies - information on which they might base their petitions for participation in our program.

Perhaps one effective method of relating to you the picture of this changing scene is to resort to the use of some statistics. NACA's budget for fiscal '59 was set at slightly more than $100,000,000, almost all of which was to be expended in its own laboratories. When NASA took over on October 1, this budget jumped to $335,000,000 as a result of transfers from the military services and an appropriation by the Congress. We are hopeful that action will be taken soon to appropriate $48,000,000 as a supplement to that amount, thus making our total appropriation for new obligations in the current fiscal year - 1959 - almost $385,000,000. Our request for funds for FY 1960 totals $485,000,000. Measured in dollars, then, we will have a five fold increase in activity to manage in a single year.

Since much of this total will be expended by contractors --the military services, industry and the universities -- we have had the task of assembling a staff of specialists capable of negotiating both in the technical and business administration areas. Here again some statistics may be of interest to you. Since October 1 last year our budget and fiscal division has grown from a total of 18 to 31 people. In the public information field,where we are still under-staffed,we have had to increase from 7 to 23 people. NACA's legal staff consisted of two professional and one clerical persons. Today we have 11 lawyers and 11 support personnel. In procurement we have grown from 10 to 18 and will require a substantially larger staff as the full load of contract negotiations hits us. A new office of International Programs is in the process of organization. And an office of Program Planning and Evaluation has been established. Our personnel people have had to process more than 5,000 applications for employment -- mostly non-technical -- in the last six months. As I recite these figures, I am all the more mindful of the devotion and effort that has been shown by our staff members, new and old alike, throughout the difficult period in which we find ourselves.

On the technical side, we have had to create an entirely new organization to plan and administer the Space Flight Development tasks that are so large a part of NASA's total mission. Abe Silverstein -- who spoke to you on Thursday and who is widely known and respected for his contributions to research in all areas of flight, has had the immediate job of staffing the technical organization that could properly administer this large and growing development undertaking. I know he would be the last to say that he has completed this task. I will say without qualification that he has already accomplished much and that what he has done, he has done well. And the addition of the Jet Propulsion Laboratory to our family of Research Centers has added great strength to our Space Flight Development organization.

Still another way to look at the nature of our operation is to list some of the meetings with various interested groups and agencies that have kept the management of NASA so fully occupied since October 1st. These have been particularly time-consuming for me. As a university president, I have been accustomed to meeting fairly often with our trustees, with alumni organizations, with teaching groups or student associations. I have been reasonably responsive to invitations from groups who sought "a speaker with a message." But the number of councils, agencies, and committees that in recent months I have discovered must be kept informed of our progress in this still glamorous field of space research can be described only as phenomenal.

As you know, there are two Congressional Space Committees -- the Senate Committee of 15 members, headed by the Majority Leader, and the House Committee of 25 members, whose Chairman from Louisiana is one of the ranking Representatives. These Committees have performed an important service in gathering technical data and opinions on space flight from a wide variety of sources. They were largely instrumental in shaping our present space policy; and it is a privilege, as well as a duty to fill them in regularly on our progress.

There are also the Appropriations Subcommittees with special concerns and responsibilities for the financing of our aeronautical and space programs. There are other committees such as the Government Operations Committee -- that probe the seeming overlays and duplications by the several agencies with interest in space matters. And there are still other Committees "on the Hill" to which we may expect to be called for detailed accountings about one aspect or another of our activities.

During NASA's first three months of operation, the Congress was in recess. Beginning late in January, we have been invited to Capitol Hill six times for detailed discussions of our program. And our appropriation hearings are still ahead of us. Our key executives have invested something like 1500 man-hours in preparing for these hearings. In most instances, this has been time well spent, but it is a drain on the mental and nervous energy of busy people.

Some attention -- yes, a rather considerable amount of attention -- must be given to the matter of tremendous public interest in our posture and position in space matters. It may be argued by some that this public concern is not a truly enlightened interest -- my own feeling is that if and when the American people are told the facts of a situation they react promptly and wisely. Regardless, it is obvious that by the terms of the Space Act our operations must be conducted in a goldfish bowl, with all the disadvantages and advantages, if any, that result from such an exposed posture.

We have adopted the position that we will talk with candor about what we have done -- and this includes frank discussions of such of our experiments as must be classed as failures, just as surely as it includes reports about our successes. But it does not, and in my opinion it should not, include fanciful promises about what we would like to accomplish in the days ahead. Even assuming that good fortune will smile on all our future efforts -- and you and I know this won't be the case -- we will still do better by doing first and talking afterwards.

Because NASA is directly concerned with contracting for industrial assistance for the first time, we have felt it necessary to explain our needs and our procurement methods to the companies with which we might be dealing. Conversely, industrialists have wished to acquaint us with their capabilities. Since October, our technical staff has participated every week in numerous briefings for and by the space, missile, and aircraft industries. At a rough estimate, they have devoted well over 2,000 man-hours to such briefings.

My own duties -- and those of Hugh Dryden -- require attendance at meetings of the National Aeronautics and Space Council, which is headed by the President.

Occasionally, either Hugh or I are called upon to sit in on meetings of the Cabinet or the National Security Council. We spend a good deal of time in discussions of an informal nature with the Special Assistant to the President for Science and Technology.

We've been too busy in the last few months to keep an accurate record of these outside meetings. But our staff has estimated that 70 per cent of our time - Hugh's and mine - is scheduled for conferences of one kind or another, a majority of them away from our desks.

Another group with which NASA has to coordinate its work is the Civilian-Military Liaison Committee, set up to facilitate the interchange of information between NASA and the DOD. In addition to the Chairman, the Committee has four members from NASA and four representing the Armed Forces.

In preparation for Committee meetings, our members and their alternates have to put in hours of preliminary staff work, just as we do before meetings of the Space Council. This time does not include our day-to-day, informal discussions with the Advanced Research Projects Agency of the Department of Defense, or with various other planning groups within the military Services. There is no way to estimate the amount of NASA time that goes into such meetings, but certainly it is considerable.

One of the real privileges we have is to get away from the desk once in a while and spend a few hours or days at scientific gatherings like this Colloquium, where several high executives of NASA have been occupied for the past two days. We feel that meetings of this kind are essential; that they provide useful opportunities for the exchange of ideas and data with our colleagues in the various disciplines that bear on space research.

All of this recital is intended to impress you with the fact that there are only a few hours remaining to members of our top technical and administrative staff for the accomplishment of our basic purpose. Actually, of course, while many of us are engaged in the frenetic activities I have described, most of our scientists and engineers are working very hard, planning bold, imaginative, and extensive programs of space research -- and pressing them forward with great vigor and urgency. But it is well to recognize the realities of life in Washington when you think of translating some of your dreams and ideas into practical, effective programs of research and development.

As I read over this paper it occurred to me that this audience might be getting an idea that I am complaining about all of this. Really - I'm not complaining - I'm explaining what our democratic machinery requires of us whenever we undertake to spend large sums on large enterprizes. And research and development in space is a large enterprise in which your money and mine will be spent.

I am satisfied that, frustrating as it may at times be, this process of ours, in the long run, will give us more right answers than wrong and will go farther than any other system toward insuring that the benefits of our research will be applied for the peaceful and productive purposes of mankind. The checks and balances that are built in to our way of doing these things simply require that all of us work at the tasks before us with dilligence and with faith in the essential rightness of the democratic process.

While it must be clear to all of you that our task is not a simple one and that we have managed, thus far, to do little more than get our organization under way, I hope it is also clear that we have acquired substantial momentum. And I am happy to be able to assure you, in the words of Dr. DuBridge, that our program and operations are "based on realities rather than on fancies."

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

EX 3-3260
Ext. 7827

NASA RELEASE NO. 59-104
FOR RELEASE: AM's Tuesday
March 24, 1959

NASA ANNOUNCES CONTRACT FOR VEGA ROCKET ENGINE

NASA announced today the signing of a $5 million contract with General Electric Company for development of a liquid propellant engine to power the second stage of the Vega space vehicle.

The engine will be a modification of the Vanguard first stage engine. Combined with an Atlas vehicle as the first stage, the Vega will be capable of carrying significant payloads on interplanetary missions. It will have a payload capability of about three tons in an earth satellite orbit.

Fueled by liquid oxygen and kerosene, the engine will develop some 35,000 pounds of thrust.

Additional capabilities are anticipated by addition of a third stage to be powered by a storable propellant engine now under development at NASA's Jet Propulsion Laboratory.

Under the G. E. contract, modifications on the Vanguard engine will include development of an ignition system capable of a start and restart under space conditions. This will be used on certain missions where it is necessary to achieve a coasting period and then reignition in order to establish an orbit at high altitudes.

Delivery of the Vega engine is expected early next year.

-END-

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Tel. EX 3-3260
Ext. 6325

FOR RELEASE ON DELIVERY:
(Expected about 10:00 A.M.
Tuesday, March 24, 1959)

Statement by

Dr. T. Keith Glennan, Administrator

National Aeronautics and Space Administration

before the

Subcommittee on Governmental Organization for Space Activities

of the

Senate Committee on Aeronautical and Space Sciences

March 24, 1959

Mr. Chairman and members of the Committee:

I appreciate this opportunity to come before you today to discuss NASA's role in the national space program and our relationships with the National Aeronautics and Space Council, the Civilian-Military Liaison Committee, the Department of Defense, and other groups.

May I say parenthetically that to me it is a constructive and healthy thing for the committees of Congress to be continuously concerned about the possibility of harmful conflicts and duplication in agencies of the Federal government.

Before I describe the current situation in our national space effort, I think it would be worthwhile to review, very briefly, the past history of our efforts in rocketry and space technology, the road over which we have traveled to date.

In 1926, the world's first successful flight of a liquid-fuel rocket was conducted by an American scientist, Dr. Robert H. Goddard. Earlier he had done much pioneering theoretical work in rocketry, and had calculated the requirements to send man-made objects into space. Incidentally, Goddard concluded that by proper use of the rocket staging which he had invented, a space vehicle could be propelled to the moon! Unfortunately for us, he was regarded more seriously in Europe -- especially in Germany -- than in this country.

There is, I believe, a sobering parallel to be drawn between our neglect of rocketry for decades after Goddard and the earlier American refusal to recognize and exploit the potentialities of the Wright brothers' airplane. It was not until 1915 that the Congress established the National Advisory Committee for Aeronautics, to "study the problems of flight," and it was not until after World War I that we were able to regain aeronautical leadership.

Intense effort in Germany in the field of rocketry resulted in development of the V-2, almost in time to affect profoundly the course of World War II. That effort provided the basis for Doctor-General Walter Dornberger, commander of Peenemunde, to declare prophetically, some 15 years ago, that "We have led our generation to the threshold of space -- the road to the stars is open."

With the end of World War II and the resumption of peaceful pursuits, only a very few in the U. S. -- with limited funds -- continued to work with rockets and missiles.

Within the Air Force, studies had been followed in 1946 by the award to what became the Convair Division of General Dynamics Corporation of a contract for Project MX-774, the forerunner of the Atlas. Although this project was cancelled the next year, largely for reasons of economy, Convair continued to work on problems associated with development of an intercontinental ballistic missile, and had accomplished much by 1953 when the scientific breakthrough was achieved that permitted packaging a nuclear payload with a relatively small, reasonably light-weight but high yield warhead. Of equal importance was the Air Force sponsorship, beginning in 1951, of development of rocket engines with large thrust by the Rocketdyne Division of North American Aviation, Inc.

The Navy also contributed to peacetime development of rocketry. Naturally, its missile programs were oriented to reflect requirements peculiar to that service; launching a missile from the deck of a rolling, pitching ship posed numerous problems, including the need to perfect special guidance apparatus. With its Viking and Aerobee missile programs, the Navy became active in upper atmosphere research, learning much about the atmosphere at altitudes above 100 miles, and the instrumentation and operation of such missiles.

Similarly, Army interest in ballistic missiles and rocketry was maintained after the war, and the capabilities of the pioneering Jet Propulsion Laboratory, operated under contract by the California Institute of Technology, were strengthened and enlarged. The Army also employed effectively the talents of about 125 German scientists and engineers who had worked on the V-2. Using both reconstructed V-2's and the WAC-Corporal, and finally a combination of the two, called Bumper, altitudes of 250 miles were reached.

At Wallops Island, the NACA in 1945, fourteen years ago, began using rockets to propel its research vehicles to constantly higher speeds. Nearly 3,300 firings have been made since then, with a reliability rate that is gratifyingly high. Even more important was the need to develop and refine telemetering devices that enabled us to record the research data gathered in flight.

I have detailed American activity in rocketry in the 1945-55 era because it is important to realize that in the United States we had developed a substantial competence in some of the basic elements of space technology, even though our interests in space -- official and otherwise -- during this period were pretty much confined to studies by a few far-seeing individuals.

By 1955, however, we were able to undertake a scientific data-gathering satellite project as part of the U. S. contribution to the International Geophysical Year, 1957-58. Each of the Military Services submitted plans to the Secretary of Defense, suggesting how the project should be accomplished. The final decision was based on a determination that the satellite project should not in any way be permitted to interfere with the ballistic missile programs-then, as now, being prosecuted on a top priority basis.

The result -- Project Vanguard -- was a tri-service effort, with overall management responsibility administered by the Office of Naval Research, with Dr. John P. Hagen,the project director. To avoid interference with the missile program, it was decided to develop in less than three years, almost from scratch, a fully integrated three-stage rocket launching vehicle, capable of lifting a highly-instrumented payload to an altitude of about 300 miles, and of imparting a speed of five miles per second parallel to the Earth so that a stable orbit could be attained. Project Vanguard broadly conceived, was more than just a rocket or a satellite; it was a system, a complete and totally integrated space research program. In addition to development of the vehicle itself, it provided world-wide tracking systems, both radio and optical, and the launching system to place the satellite in orbit.

As every American knows, Project Vanguard was beset by troubles that would have discouraged all but the most stout-hearted and dedicated of research teams. Last fall, the Vanguard team and the four remaining satellite experiments were transferred to NASA. We had confidence in the inherent rightness of the program, and last month, after a thorough re-working of the vehicle, the successful orbiting of Vanguard II did much to affirm that faith. Viewed in retrospect, it is doubtful that any single rocket program has had a better record of successes in the limited numbers of firings under-taken.

Earlier this week, the first anniversary of the initial Vanguard success was observed. Speaking on that occasion, Dr. John Hagen said: "Vanguard was the first true space vehicle. It was a finely designed and very efficient vehicle. As the United States Space Program progressed, components and stages of Vanguard were found -- sometimes anonymously -- in nearly all of the vehicles using larger boosters to achieve even more difficult space tasks. The second and third stages in combination were found on top of Thor boosters as lunar probes. In vehicles still on the drawing board, one finds not only the second and third stages of Vanguard but the first stage, with modified tanks, planned for use on top of an Atlas. Known as Vega the Atlas-Vanguard combination will be used for deep space probes. Many significant advances were made in electronic techniques ... and some of the hardware has helped in other programs and will contribute to many future space programs."

In summarizing the events leading up to our first efforts to explore the mysteries of space, we must remember the first U. S. satellite, Explorer I, which was the speedy development last year by the Army-JPL team. It was but the first of the Explorer series of satellites. I must mention also the space probes by the Air Force and the Army, performed first under the direction of the advanced Research Projects Agency and, since October 1, by NASA.

Now, I want to turn briefly to the Russian efforts in the fields of rocketry and space technology. They, too, have had early pioneers, Tsiolkovskii, who began this work late in the nineteenth century being perhaps the first and best known outside of Russia. Although their rocket accomplishments prior to 1945 did not match those of the Germans,there was sustained Russian interest during those prewar years in the development of long-range missiles. With the end of the war, there was thorough and intensive Soviet exploitation of German rocketry. They developed larger rocket engines to power their ballistic missiles, and by the late 1950's they had the propulsion equipment to put heavy payloads into satellite orbit.

Any doubts we might have had about Soviet intentions or capabilities in space were dispelled on October 4, 1957. The Sputniks and Lunik established Russia's high order of competence in space technology. We learned, too, the lesson that early success in a field of science as new and difficult as the space field has tremendous potential for influencing world opinion.

Eighteen months ago, we in the United States were shocked into the realization that the Russians were demonstrating by spectacular performance their determination to excel in an area of science and technology where we had confidently assumed we enjoyed supremacy. Since then steps have been taken to assert American leadership.

An important and far reaching organizational move was the passage last July of the National Aeronautics and Space Act. Last August, during the Senate Committee hearing on my nomination, I was asked what I thought about the Act and I said I felt it was "an Act under which we can get ahead and if I had not thought this to be an important activity of this Nation, I should not have accepted this appointment..."

I still feel this legislation is sound. I also believe there is a continuing need to review our organization for space. In a dynamic rapidly changing technology like this, it is well to keep an open mind on the question of the best method of organizing to accomplish the difficult and costly jobs the nation is demanding of us.

Within NASA we have been engrossed in organizing for the tasks ahead and getting them surely and rapidly under way. We have been able to do it within the framework of the legislation.

As a prelude to a detailed discussion of NASA's relationships with the military, I would like to quote from Senate Report 1701, issued June 11, 1958 on the essentiality of civilian control in space matters:

"Faced with the potential of what space may someday mean to their society and its institutions, Americans would reject without compromise any suggestion that this authority be vested in other than civilian hands. The essentiality of civilian control is so clear as to be no longer a point of discussion.

"Whether the operating heads of any special agency are in uniform or out of uniform, however, does not of itself settle the meaningful issue of civilian control. Equally important -- and probably more so -- is the matter of civilian dominance versus military dominance. We can so construct our administrative edifice that an agency under civilian control would actually be dominated by the military.

"The military has a specialized interest in space, not for motives of preemption, but for the simple reason that military capability in space is necessary for fulfillment of the missions assigned the services. Presently, as since the birth of the Nation, control of the military is civilian. It must be presumed that this control is fully as adequate and competent as would be civilian control of a space agency.

"Your committee believes great mischief could be wrought by delegating to a civilian Space Agency authority over military weapons systems and military operations in this field.

"If the civilian Space Agency is to be actively involved in military affairs, at an administrative and decision-controlling level, then the preponderance of its attention, interest, and perhaps eventually its understanding will fall to military matters to the exclusion of non-military endeavors. Civilian uses of space will be cast in the perpetual role of competitive bidding for attention and consideration against a preponderant military."

How efficiently has this civilian-military space structure been working out in practice, and how does NASA carry out its mission within its framework?

I do not plan to discuss the organizational details of the Defense Department's space activities; there are others far more qualified than I to do so. I can, however, tell you about our space program and describe how our relationships with the Armed Services have developed in the months since NASA's creation.

In the short period of time in which we have been operating -- and I point out to the members of this Committee that we have been in business only six months -- NASA and the military have functioned without undue friction or duplication of effort. We have moved forward with dispatch at NASA; this has been done, in my opinion, without interference in the military space program. A brief rundown of the national space organization chain of command will show you what I mean.

As you recall, it was decided that the President of the United States should serve as Chairman of the National Aeronautics and Space Council and that he should have the ultimate decision-making power in the matter of programming and allocation of responsibility as between NASA and the DOD.

Advising the President on all aeronautics and space activities is the National Aeronautics and Space Council. Its members include: Secretary of Defense Neil H. McElroy; Secretary of State, John Foster Dulles; Atomic Energy Commission Chairman, John McCone; the Administrator of NASA; J. T. Rettaliata, President of Illinois Institute of Technology; National Science Foundation Director, Dr. Alan Waterman; National Academy of Science President, Dr. Detlev W. Bronk; and New York attorney, William A. Burden.

A Civilian-Military Liaison Committee headed by William M. Holaday provides a channel for coordination and interchange of information between NASA and the DOD.

For purposes of this discussion, the outline I have just sketched is the basic organization to carry out the national space program. Many other organizations and individuals make important contributions and I will discuss them later.

The civilian-military space structure includes a number of checks and balances which work toward cooperation between the two wings and away from duplication of effort.

The highest-level checkpoint is the Space Council. While it is true that Defense and NASA leaders report directly to the President, their respective programs reach him at the Space Council level in the context of a national program.

Here he reviews with the Council the civilian and military components of the program and sees to it that they move forward in harness.

Let's take as examples the space vehicle, tracking and manned satellite programs.

...The President has assigned NASA responsibility for new space rocket engine and vehicle development, with one exception: the one-and-one-half-million-pound clustered rocket engine.

NASA will develop the one to one-and-one-half-million-pound single chamber rocket engine which will take longer to complete than the clustered engine.

Each engine will be available to both Defense and NASA. In their development, care is being taken to take into account the needs of the military as well as the civilian space programs.

...In the realm of tracking and data reduction, Secretary of Defense McElroy and I have reached an agreement whereby both agencies take full advantage of each other's facilities.

Under this agreement NASA will be funding and managing new tracking stations in Australia and the Union of South Africa; Defense is planning new military tracking facilities in Spain and the Far East.

...Finally, despite reports to the contrary, there is only one U. S. manned-satellite program: NASA's Project Mercury. I think misunderstandings about duplication occur in this program because so many groups and individuals are making important contributions -- the aero-medical agencies of the Air Force and Navy, for example. And representatives of each of the services are regular working members of the Project Mercury team.

The Civilian-Military Liaison Committee, which meets monthly, provides another checkpoint, another chance to say, "Wait a minute, let's be sure we know what right and left hands are doing." And in this regard, we are now approaching an agreement whereby military men with needed skills can be assigned on temporary duty to NASA projects -- and vice versa.

In these cooperative activities we are carrying on the rich 43-year tradition of our predecessor organization, the National Advisory Committee for Aeronautics. As any military man will tell you, there is hardly an aircraft or missile in the air or on the drawing board that has not benefited importantly from NACA -- now NASA -- research.

I think we all agree that there is, at present, little difference between military and civilian space research and development. The difference comes in application of its results, and in the degree of secrecy governing the activities.

For example, in the case of a cloud cover satellite, although the military and the Weather Bureau might have diverse end-item requirements in developing the basic tools, there is essentially no difference.

Another point: There is a form of duplication in science and engineering that is most useful. Let's call it "parallel approaches" to a research problem to assure the best given result -- particularly when there is a deadline involved. Such programmed duplication can occur within a single agency as well as between two separate agencies. I would not be so naive as to attempt to convince you that unplanned duplication does not occur. Of course it does, but I am of the opinion that it is not so widespread as one is sometimes led to believe.

I don't mean to imply by the foregoing presentation that we do not have problems. We have them in direct ratio to our growth in size and responsibilities. We are facing the same management problems confronting any large government or industrial complex.

There is no blinking the fact that the continual coordination -- and the layers of authority -- slow down the decision-making process. But there is never any quick and easy solution to such problems. Despite this, however, we have been able to take a number of time-saving steps. For example, we deal directly with the Army Ballistic Missile Agency and the Air Force Ballistic Missile Division. We hope to maintain a close and effective relationship at the working level in all of our projects where joint interests appear. Thus far, there have been no instances in which reasonable solutions to questions of jurisdiction have been impossible to reach.

Before concluding this rundown of the military-civilian relationship, I want to reiterate my recent testimony to the effect that NASA's research centers are currently hard at work on problems affecting all of the Nation's major intermediate and intercontinental ballistic missiles as well as anti-missile systems under development. This is in line with that provision in the National Aeronautics and Space Act of 1958 which stipulates clearly that NASA shall have a very close relationship with the military services and make available to them every development with military application. And I would remind you that NASA continues to be the government's principal center for aeronautics research. Important contributions to the design of high speed, manned aircraft are coming from our research centers every day.

In conclusion I want to emphasize the many resources NASA calls upon in carrying out the civilian space program. What I outlined earlier was the skeleton, decision-making chain of command from the President, with the advice of the

Space Council, to Defense and NASA. And here I think we find a root of some misunderstanding: when you reduce to a chart all of the non-decision-making bodies with which we deal, it looks complex in the extreme -- a tangle of boxes and dotted lines.

For example, NASA is working closely with the Space Science Board of the National Academy of Sciences in the development of its space sciences program. On the international front, we are cooperating with the Committee on Space Research (COSPAR) of the International Council of Scientific Unions and the United Nations. Some of our tracking stations abroad are manned by nationals of the countries in which they are located.

In the field of payload experiments and packaging, we deal with numerous organizations. Universities, industry and government have all had a hand in preparing experiments for satellites and space probes whereas we deal thus far with only four principal groups with payload packaging capability -- the Jet Propulsion Laboratory at the California Institute of Technology and the Vanguard group (both within NASA); the Space Technology Laboratories, Inc., Los Angeles, and the Army Ballistic Missile Agency. Several industrial organizations also are developing a capability in payload packaging.

Finally, we inherited from NACA a dedicated staff of some 8,000 fine scientists, engineers and administrative workers in five laboratories and field stations in Virginia, Ohio, and California.

On March 13, the President established a Federal Council for Science and Technology to promote closer cooperation among Federal agencies in planning their research and development programs and recommend ways in which the government can assist in strengthening the Nation's scientific efforts as a whole. As NASA Administrator, I am a member of this Council. In contrast with the National Aeronautics and Space Council, the work of which is as its name implies, concerned with aeronautics and space, the Federal Council of Science and Technology is concerned with the extremely broad field of all government science and technology, including agriculture, medicine, geology, oceanography, and so forth.

For recent Congressional testimony we prepared a chart of scientific cooperation between NASA and other agencies. With this chart which I have brought along today, I will proceed clockwise and describe our relationships.

I've already talked about our connections with Defense which are in the fields of research and development, and in this area the Army and the Air Force particularly have been providing us with boosters, booster systems and launching facilities.

Again, with the Department of Commerce and the National Bureau of Standards we have an R & D relationship, especially in the meteorological and geodetic fields.

We have affiliations with the Treasury Department's Coast Guard in flight safety and others of our aeronautical programs. Similarly, we have relationships with the Federal Aviation Administration in matters of flight safety, range operations and the like.

The Department of State assists in our international cooperation activities.

In connection with our aeronautical research activities, we have many dealings with the Civil Aeronautics Board.

I have already discussed our relations with the Space Science Board and the FAA.

The Smithsonian Institution has had responsibility for certain of the satellite tracking activities; the U. S. Information Agency works with us on promulgation of information abroad; we have a close tie with the Atomic Energy Commission because of our interest in the development of nuclear rocket engines and miniaturized satellite power plants.

The National Science Foundation conducts basic research in many areas of interest to NASA.

The Space business is complex. We have been moving at a fast clip -- organizing on the run. We are making headway but as I said earlier, in the time we have left over from our main effort to get on with our task, we are searching for better, more efficient ways to accomplish the desired end result -- leadership in space. Rear Admiral John T. Hayward has a favorite saying - "You don't invent on schedule." To an extent, this statement is applicable in the business of organizing our national space effort. Given the desirable separation between civilian and military space activities, I think we are doing well in meeting the objectives set for us.

- END -

NASA Release No. 59-105

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

NASA RELEASE NO. 59-106
FOR RELEASE: PM's Thursday
March 26, 1959

PROGRESS REPORT ON MERCURY CAPSULE DEVELOPMENT

Intensive programs of basic and applied research, part of the early phases of Project Mercury, are supplying valuable information leading to a safe and reliable manned satellite capsule, the National Aeronautics and Space Administration said today. The research programs are being conducted in support of the development of the major Mercury subsystems.

Significant progress has been made to date in four general areas: air drops; escape; scale model studies, and impact tests. The Mercury program is administered by the Space Task Group with headquarters at the NASA's Langley Research Center in Hampton, Virginia. Robert R. Gilruth is project director.

A summary of the research programs now under way follows:

AIR DROPS

The terminal phase of the Project Mercury flight -- safe recovery after the capsule reenters the atmosphere -- was an initial consideration of space scientists. Theoretical and experimental studies of this problem were considered by scientists of the NASA-Langley Pilotless Aircraft Research and the Flight Research Divisions some months before the Space Task Group was formed.

Essentially, the air drop program is designed to tell scientists the optimum altitude at which to deploy the recovery parachute; reliability of the parachute system; motions which can be expected during descent; impact forces in both water and ground landings, and reliable methods of recovery after landing.

Before tests began at Wallops Island in the fall of 1958 NASA scientists developed methods for dropping a full-scale model capsule from its carrier -- a C-130 Hercules transport -- during the late summer over Salerno and Normandy drop zones at Fort Bragg, N. C., and over the deserted airfield at West Point, Va.

Full scale two-ton models used as test vehicles are staged out of Langley, where capsules are loaded on a Hercules transport loaned the NASA by the USAF Tactical Air Command. The test vehicle is dropped into a free fall and is photographed in its descent by two T-33 chase planes. One chase aircraft is stationed at the same altitude as the C-130, and the other at the altitude where the recovery parachute will be deployed.

When the capsule impacts, two Marine HUS helicopters from Quantico and an NASA crash rescue boat from Wallops Island, go to the impact spot. One helicopter, directed by the other HUS and the crash boat, retreives the capsule by shackling a line to an eye located on top of the test model.

Detailed studies of the entire operation are made from motion picture films taken by the T-33 jets.

ESCAPE TESTS

When the Mercury capsule is launched, it will have on top of it a pylon-like arrangement tipped with an escape rocket system. If the booster malfunctions at any time **from pad to staging an** escape rocket can be triggered and it will carry the capsule and its occupant away from the booster. Normal recovery by parachute then will take place.

Reliability tests of the escape system, and aerodynamic studies of the capsule-escape combination, are being conducted from the Wallops Island launching site. With use of full scale models, scientists are determining proper alignment of escape rocket nozzles as well as dynamic forces on the capsule and escape arrangement during launch and descent.

MODEL PROGRAM

Behavior of the capsule during flight is being studied at the Langley and Ames wind tunnels and soon at the Arnold Engineering Development Center, Tullahoma, Tenn. Free-flying model studies are being conducted at Wallops Island for the same purpose.

At Wallops, small models are subjected to the full velocity range to investigate tumbling characteristics, reentry dynamics and afterbody heating. For these studies, capsule models are placed on the tips of research rockets.

In its extensive wind tunnel program, the NASA uses the complete range of scaled-down capsule-booster combinations planned in the build-up program. For example, build-up flights will be held with the capsule atop a Jupiter rocket; wind tunnel research is providing answers to control inputs and trajectories by investigating the lift, drag and static stability of the Jupiter-Mercury arrangement in scale models.

At Langley, scientists are employing tunnels to determine heat transfer and pressure of the heat shield, dynamic stability, afterbody pressures, pressure distribution, and lift and drag. The Langley tunnels cover the velocity spectrum from just a few miles per hour to Mach 18 (11,000 mph).

At the Ames Research Center, Moffett Field, Calif., wind tunnels are used to study panel flutter, pressures and heat transfer, static and dynamic stability plus lift and drag in the Mach 0.6 (390 mph) to Mach 15.3 (9,950 mph) velocity range.

Lift, drag, stability and pressure distribution studies in the speed range of Mach 0.5 (325 mph) to Mach 20 (13,000 mph) are scheduled at the Arnold Center.

IMPACT TESTS

When the Mercury capsule descends after its orbital flight, it will fall with a velocity of 30 feet per second. Drop tests at this velocity in the water tank facilities at Langley have shown that a safe water reentry can be made with the presently-shaped leading face on the capsule. In the event of a ground landing, scientists are conducting studies into a crushable material which can absorb the landing shock. Materials now under study include honeycombed arrangements of corrugated plastic and aluminum, as well as the more fibrous cellulose materials.

In these tests, scientists are dropping instrumented models in water tanks and on hard surfaces from all impact angles, using a variety of materials and arrangments.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

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PRESS CONFERENCE

THEORETICAL PROBLEMS ASSOCIATED WITH THE VAN ALLEN LAYER

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1520 H Street, N. W.,

Washington, D. C.

Friday, 27 March 1959, 4:30 p.m.

PRESENT:

PROFESSOR THOMAS GOLD, Harvard University.

PROFESSOR EUGENE PARKER, University of Chicago.

PROFESSOR NICHOLAS CHRISTOFILOS, University of California.

MR. ROSEN: This is a press conference called to illustrate some of the work that the National Aeronautics and Space Administration is doing in the area of theoretical studies in the space sciences. It is under the sponsorship of NASA's Theoretical Division, headed by Dr. Robert Jastrow.

Today and yesterday the Theoretical Division held a conference on theoretical problems associated with the Van Allen Layer. They had a large assemblage of people, the top people in the United States in this business of auroral and upper atmosphere phenomena.

Today we have with us Professor Thomas Gold of Harvard University; Professor Eugene Parker, on the end; and Professor Nicholas Christofilos, of the University of California.

Dr. Jastrow will give you a rundown on the results reached at this conference. I now introduce Dr. Jastrow.

QUESTION: Where was this conference held?

MR. ROSEN: At NASA Headquarters.

DR. JASTROW: It was a small conference, planned in January with three formal papers scheduled as nuclei for the discussion that we expected.

The purpose of the conference was a discussion of the properties of radiation belts and their geophysical effects. It is a part of a series of seminars that the Theoretical Division has organized on frontier areas in the space sciences. They have been extremely stimulating thus far.

The series started with a set of two lectures by Urey on the moon and planets. We had a number of excellent lectures after that on relativity theory and related subjects. Around the beginning of the year, the time seemed ripe for an informal free-for-all on the origin and the geophysical significance of the trapped particle layers.

There will be a formal session on these problems as a part of the joint Symposium of the National Academy of Sciences, NASA, and the American Physical Society, which is scheduled for the end of April. As a matter of fact, at that meeting, each of the three speakers that we had at our informal conference is also scheduled for a formal presentation.

But we wanted to get together into one room as a group of theorists and experimentalists with interest in this problem, to try to tear one another's ideas apart and to see what could be said with firmness at this point about the properties and the consequence of that trapped particle layer.

I would like to give you a brief summary of the properties of the layer, and in particular an account which we prepared at the close of the meeting, just about one hour ago, which summarizes those points on which we could reach agreement. There is still a great deal of argument, I think; about half of the conference participants are still arguing in the ninth floor conference room right now. But there were a few points on which we could reach some agreement.

First, I should like to tell you something about the radiation belt. There has been a great deal of material published in the press and in technical literature. Some of it came from experiments immediately after they were performed. The dust has settled in certain respects and I think we can make the following specific statements.

First of all, the radiation belt is somewhat misnamed. It is a belt of particles, rather than radiation. These particles are known to be charged. The reason that we know they are charged particles is that the intensity of these particles is found to follow exactly the configuration of the Earth's magnetic field. The magnetic field acts on charged particles; it does not act on light rays in particular or on neutral particles. So we know these are charged particles. We know from the great deal of work, actually going back to papers published by Stormer in 1909, that these particles are trapped in orbits in which they spiral about the lines of magnetic force in the manner of a helix, travelling back and forth between the north and south magnetic poles.

It develops that if the particle is produced on a line of magnetic force at an altitude which is well out of the atmosphere where the density of air is very low, then it can live for a long time, going back and forth from one reflection point in the northern hemisphere to the conjugate point in the southern hemisphere.

Under these circumstances you can feed particles into the radiation layer at a very slow rate, but because they stay there so long the population of particles in the layer can build up to very substantial values. And that is the key to the formation of the radiation layer.

The estimates of the lifetime depend on altitude, and range from seconds at a few hundred kilometers to years out at a thousand kilometers. This is a matter which will have to be discussed in April. For the moment, we can only make this order of magnitude estimates.

The experiments that Van Allen performed with his collaborators indicated that the trapped particles have energies varying from about 100,000 volts up to 6,000,000 volts or more. Six million volts was the minimum. In fact, Van Allen divided the trapped particle population into a soft component, which means something that has low energy and can't go through a heavy wall of material, and a penetrating or hard component, meaning very energetic particles that can penetrate, for example, a quarter-inch slab of aluminum.

As for the penetrating particles, he knows only that their energy is great enough to penetrate that quarter inch of aluminum. That means that they had at least a six million volt energy of electrons, but they can still be more energetic.

The origin of the belts may be either the beta decay of cosmic ray neutrons into electrons and protons -- I will explain that -- or it can be some process of injection into the outer atmosphere by streams of energetic particles which come from the surface of the sun.

The latest data from Pioneer IV, by the way, which were presented very informally by Van Allen's collaborator, Professor Ray, definitely indicate that the outer belt is fed by particles from the Sun.

The origin of the inner belt is not clear yet. This is what all the argument has been about, and there are still arguments going on. Gold and I like to believe that the inner belt may also be of solar origin. A number of people, including Christofilos and Singer, favor the hypothesis of the inner belt being produced by the beta decay of neutrons.

PROFESSOR CHRISTOFILOS: However, don't exclude the possibility of very dense jets coming from solar particles.

DR. JASTROW: In other words, you do not wish to adopt a rigid position. But you prefer the beta decay hypothesis.

PROFESSOR CHRISTOFILOS: Yes.

DR. JASTROW: The beta process refers to the fact that a neutron with a life of a quarter-hour -- sixteen minutes -- has a probability of disintegrating or decaying into an electron and a proton. There is a certain number of neutrons flying through the atmosphere. They are produced by cosmic rays from outer space which create nuclear disintegrations in the outer atmosphere. Some of the backsplash from these nuclear disintegrations consists of neutrons. So there is a certain flux of neutrons in the atmosphere at all times.

Of these, as they move through the atmosphere there is always a certain small probability that such a neutron shall undergo a disintegration to electron and proton.

You see, the neutron is not affected by the earth's magnetic fields. But as soon as it disintegrates into a negative electron and a positive proton, they are instantly trapped in the part of the field in which they are produced.

This is the beta decay theory of the origin of the trapped particle layer. It seems to be excluded as far as the outer belt is concerned.

One last remark. The radiation belts have a number of interesting geophysical consequences. In this schematic representation of the two belts (chart), you will notice that the outer belt which follows the geometry of the lines of force of the magnetic field comes down towards the earth at high latitudes and low latitudes, the latitudes, namely, at which the aurora is produced.

Immediately one is tempted to connect the particles in the Van Allen Layer with the existence of the auroral disturbance. It does in fact seem to be very probable that the aurora is produced by excitations of the atmosphere, in turn caused by collisions of these energetic Van Allen particles with the atoms and molecules in the atmosphere.

QUESTION: Does or does not?

DR. JASTROW: It does. Positive statement. This is one major geophysical consequence in a potentially important line of research.

Also, rocket density measurements have shown that the atmosphere above Fort Churchill, in the Canadian Arctic, is actually hotter than the atmosphere over Arizona, where a large number of other rocket experiments have been performed.

It is difficult to understand why the air should be hotter in the Arctic than over Arizona, at 200 kilometers or so. But the reason is probably that the Van Allen Layer heats the upper atmosphere. Because you see all the particles of the Van Allen Layer are funneled by the earth's magnetic field into this zone which comes down around the auroral region. So that you have the surprising result of a hot atmosphere in the Arctic, probably explained by the Van Allen Layer.

From the viewpoint of fundamental research it is these geophysical effects which are what make the layer interesting to physicists.

Now, for a summary of our principal conclusions, and then we will introduce the speakers.

The first measurements by Van Allen in the Explorers I, III, and IV, indicated two components of energies mentioned, going up to 2,000 kilometers and coming in at around 500 kilometers. We are a little unclear exactly where one should put the lower boundary of the Layer.

Pioneer III extended the measurements of radiation out to a distance of 110,000 kilometers and it showed that the radiation belt actually has a thickness of 60,000 kilometers and consists of two belts, one with a center at 13,000 kilometers and the second one peaked at about

25,000 kilometers.

Getting back to the summary of the hard facts, the following results came out of our discussion regarding the nature of the particles in these two belts.

First, for the outer belt the investigators working with Van Allen believe that the outer belt consists of electrons, or rather has a strong soft component which is probably electrons of energy, about 50,000 volts.

Also, the Russians have given a statement out regarding the results of their space rocket; namely, that the outer belt definitely contains electrons in its soft or less energetic component.

So let us say that these are probably electrons.

Van Allen's group has found in addition that there is a penetrating component in the outer belt. There are energetic particles out here, too. They are either electrons of energy greater than 600 thousand volts or they may be protons with energies of the order of 100 million volts or greater. There is not as much of this very penetrating or energetic radiation out here as there is of the soft radiation.

In the inner belt, Van Allen -- and this was news, at least news to a number of us at this conference -- Van Allen and his collaborators have applied a very ingenious post mortem analysis to the results of the Explorier IV flight, from which they conclude that the energetic particles in the inner belt are definitely protons.

There are also soft particles in the inner belt, that is, particles which are not so penetrating and not so energetic, and they may be either protons or electrons.

The ratio of the soft electrons to the energetic protons in this inner belt is about 10,000 to 1.

QUESTION: What is 10,000 to one? Rate or number?

PROFESSOR GOLD: The number crossing a cross section of the counter per second.

QUESTION: Was there an impediment or filter which would have taken out some of the soft particles?

DR. JASTROW: Yes. There were four kinds of counters in Van Allen's Explorer IV.

Some of these had thick walls and some had very thin walls. They were designed precisely for the purpose of trying to discriminate between the energetic and the soft components.

That is how one arrives at this ratio.

With respect to the origin, the Pioneer IV flight almost conclusively shows a solar origin for the outer zone.

The reason for this is that in the Pioneer IV results it was found that there was not very much change in the intensity of the inner zone, but the intensity of the outer zone was greater than for Pioneer III by a factor of between 2 and 10.

There was some dispute at the meeting over the interpretation of the data. The data are very new, of course, and it still remains to be settled precisely how much more intense the outer belt was than in the case of Pioneer III.

QUESTION: In other words, the later moon shot showed a more intense radiation?

DR. JASTROW: Yes.

QUESTION: Did it have identical instruments?

DR. JASTROW: Pioneer IV, no, it didn't as a matter of fact. It had the same two Geiger counters but I think that one of them was shielded by a much heavier wall.

QUESTION: Haven't you mis-calibrated your instruments on Pioneer III?

DR. JASTROW: No. This is intended to be a representation of the counting rates in comparable counters.

QUESTION: Earlier you said Van Allen found the peak of the belt at 25,000 kilometers. You have it at 60,000.

DR. JASTROW: I have the boundary at 60,000.

QUESTION: You mean 25,000 is the peak reported by both probes?

DR. JASTROW: No. 25,000 is the peak recorded in Pioneer III. As best they can tell from the present analysis of the data the Pioneer IV peak is shifted outward to larger distances by about 10,000 kilometers.

Here is the Pioneer III result. It levels off with a constant cosmic ray background at about 60,000 kilometers, and it has maximum of 25,000.

This one has a maximum at about 13,000 kilometers.

There is some trouble in calibrating the results at the top. That is why there is a little argument yet as to how much greater the peak was.

But as best as can be seen, the peak occurred about 10,000 kilometers further out in Pioneer IV.

QUESTION: Do you mean 35,000?

DR JASTROW: 35,000.

QUESTION: Are you talking about the peak?

DR. JASTROW: Yes.

The results show that at the point at which the Pioneer III data had leveled off into a few counts per second per square centimeter, the Pioneer IV data showed fluctuations through a factor of 4 to 10 over a period of some additional 10,000 or 15,000 kilometers.

QUESTION: These are measurements from the center of the Earth?

DR. JASTROW: These are intended to be from the center of the Earth.

The interesting feature of this result which reinforces our feeling that these are of solar origin is that these flights followed five days of intense solar and auroral activity.

This is a chart which indicates what we meant by those auroral excitations.

With respect to the inner belt the origin of this belt is not clear. Prof. Christofilos has reasons for believing that the inner belt has beta decay as its origin and will say something about that.

Prof. Gold has suggested mechanisms for producing the inner belt by solar radiation. It appears that this is an open question at the present time.

One last point is that the fact that the presence of a minimum between the peak of the two belts seemed to the conference participants to be very difficult to understand.

In other words, you can understand that there is a large concentration of particles fed by the sun, let us say. You can understand that there are particles at lower altitudes fed by beta decay or other means. But you can not on any clear mechanism understand why one belt is not merged into the other but why there should be a gap instead.

QUESTION: Can you put some numbers on the maximum and minimum points on the "Y" axis?

DR. JASTROW: Yes. This peak is about --- on Pioneer III in any case, I remember, that peak was about 10,000 counts per second per square centimeter, and at the very peak of the outer belt it was about 30,000, very roughly.

QUESTION: For Pioneer III?

DR. JASTROW: For Pioneer III.

For Pioneer IV no figures were given to us.

QUESTION: And the minimum point?

DR. JASTROW: The minimum point, I think, occurred at about 16,000 kilometers.

QUESTION: And the counts at the peak?

DR. JASTROW: About 10,000.

QUESTION: What is the count at the minimum?

DR. JASTROW: I think it fell to 3,000.

I will introduce the speakers --

QUESTION: Before you do, could I ask a question?

Did you say, in talking of the lifetime of these particles, that they range up to thousands of years at thousands of kilometers?

DR. JASTROW: No. They range up to many years, "many" meaning one to ten, or something like that.

QUESTION: Could you tell us, this business of terms, is the magnetic field one precise area, a radiation belt and so forth? Are we all talking about the same thing or can you describe limits on these fields, theoretically or otherwise?

DR. JASTROW: Yes. We know the Earth's magnetic field rather well on the surface of the Earth, and we know by very sound theories how it should vary as you get away from the surface. So we know the field rather accurately out to some distance from the Earth.

We don't know what kinds of variations in the magnetic field are produced by the various sorts of currents that we think flow in the outer atmosphere. One of the points that one gains from the study of the trapped particles is indirect information on the nature of the magnetic field, because the properties of this radiation layer, the extent, for example, to which it goes out at very large distance, depends on precisely how the magnetic field behaves as you go far away from the Earth.

The implication, by the way, in the fact that these particles no longer exist in appreciable numbers when you get out to a distance greater than sixty or eighty thousand kilometers -- in other words, about ten Earth's radii -- the implication is that around that point the magnetic field of the Earth disappears into the general noise level of interplanetary plasma and fields.

QUESTION: Dr. Jastrow, are you assuming from those peaks of Explorer out beyond 70,000 kilometers that it was encountering blobs of solar plasma beyond the Earth's magnetic field? Is that the inference when you talked about solar activity and aurora?

DR. JASTROW: Yes. I would like to let other speakers say something about that. This is indeed what they have in mind.

There was one interesting suggestion made at the conference by Dr. Dessler, of Lockheed Laboratories in Palo Alto. He pointed out that there is an irregularity in the magnetic field of the Earth over South Africa, an irregularity which can be described as a hole in the magnetic field.

He pointed out further that this irregularity is so located that it might account for the gap between the two radiation belts because the particles which are trapped in the magnetic field, when they come to this hole over South Africa, fall into it. They descend into somewhat lower altitudes than they would if the field were perfectly smooth. At lower altitudes they hit more air and they get taken out of the radiation layer.

Again, it is an open question, but it was an interesting suggestion.

Prof. Gold suggested that the origin of the belts is a stream of particles which pass across the Earth, and that these particles actually may be trapped in a belt around the sun by the magnetic field of the sun, a kind of solar Van Allen belt. And he points out that this can explain the paradox of the very long times it seems to take the particles to reach the Earth as compared to the velocities of energies that we know that these particles have when they get here.

This concludes the summary of the discussion. I wil: ask Professors Parker and Christofilos to make their own presentation. I imagine you will want to ask questions of Prof. Gold, also.

PROF. GOLD: By all means interrupt me. I don't plan to make a long speech. I will just start saying something and then ask me whatever is of particular interest.

The last evidence of this raggedness at the end was of particular interest to us because there had been previously the suggestion that the disturbances in the Earth's field that we call magnetic storms appear rather patchy on the ground here in distances on the Earth of a few hundred kilometers apart. The magnetic disturbance looks rather different.

Somebody asked whether this was actually bits of solar plasma that the thing was flying through. Most likely it would be just the outer part of the Earth's field containing a certain amount of gas that has not yet settled down to its quiescent condition that it would reach some time later. The corresponding absolutely smooth curve of the Pioneer III indicated that at that time it had settled down to a quiescent state.

So this raggedness and the fact that the layer has much enhanced argues heavily that a solar stream came and hit the Earth and that at that time it arranged in some way to feed fast particles in here, and it left a little bit of disturbance in the particle content and in the field, too, for a few days.

We know it takes some time after a magnetic storm for the Earth's field to quiet down again and recover after all the external influences have gone away. So this recent evidence fits that part of the story very well and it is very strongly suggestive, if not an absolute proof, of the solar origin of the energetic particles in the outer region.

The debate then becomes less clear as to just what happens, how do the particles get further in, what makes the dip between the two peaks, and is the inner peak made by the same mechanism. Of course, we don't know.

It is very interesting that when a new physical thing like that is discovered how often it in fact does occur, that even though to start with it wasn't predicted, when you discover it, not only is there one theory to account for it but there are several.

For example, when radio astronomy was discovered, at first everybody thought we must have all the same source for all the radio noise coming out of the sky, and a few years later we discovered there wasn't one kind of mechanism that did it but a large number of different celestial objects had different ways of doing it. So at the first stage one tries to over-simplify and make it all due to one mechanism, but one can't be sure it isn't several.

We have the great problem of how particles that are locked in the outer zone where they could be fed in from outside, how they could distribute themselves throughout the Earth's field to come closer in, and then it is a theoretical problem what kind of mechanism can transport particles from one zone in which they are locked to an underlying one. The particles that are captured in this particular place, for example, how will they get into regions that are underneath it?

Much of the discussion in this conference was concerned with that -- what mechanisms are there? One type of mechanism that can shuffle them around is that the field is being pushed around. Another part is that the orbits of particles are not quite accurately described in terms of accurately captured paths, and a third mechanism is that perhaps the gas content -- and this is one that I suggested that is novel but still being disputed -- that perhaps the entire gas content of this outer region can undergo a rather complicated internal motion which will assist in taking a whole layer, a whole bundle at one level and allowing it to appear at a different level.

I think that is all that I would like to say on this.

QUESTION: Can you explain this: If these particles, as they come off the sun, are trapped in the sun's magnetic field, what mechanism is it that releases them and gets them down to the Earth's magnetic field?

PROF. GOLD: The particles are all very easily deflected by the kind of magnetic fields that we know to exist in the vicinity of the sun. So one can not easily think of them as coming freely from the sun to the Earth. So when they come here, it must be that they come with a magnetic field that has the correct shape so as to allow them to come here.

One simple shape, of course, that the field could have is just to be radially alive from the sun toward the Earth. The sun's magnetic field might be distorted by motion of material between the sun and the Earth in such a way that it is all dragged out, combed as it were, its lines of force directed toward the Earth. And this might occur, some of us think, all the time. But whenever the field lines are suitably arranged, then particles can travel here from the sun.

The suggestion is that the aligning of the field that allows the particles eventually to come here is a process that occurs by a moderately fast gas that is being flung here by the Sun. Having come here, it has brought the elongated field with it from the Sun to the Earth, and then any much more energetic particles that the Sun is making at the base of this region can freely travel to the Earth and, therefore, reach here with a time delay of two days apparently, because they have had to wait for the field to be so stretched, although really they left the Sun only a much shorter time ago.

But we see a big outburst on the Sun and it is throwing material toward us and it takes two days to get here. And when it gets here, fast particles may also get here, whose private travel times would have been much less.

QUESTIONS: That would account for the fact that the particles in the radiation belt are moving at relatively fast velocities, whereas it takes three or four times for the first cloud of plasma to get from the Sun to the Earth travelling much slower?

QUESTION: And two or three days after the appearance of a sun spot?

PROF. GOLD: After the appearance of a solar explosion or flare.

QUESTION: Does the Sun have a north and south pole?

PROF. GOLD: Yes.

QUESTION: Is it a dipole or not?

PROF. GOLD: No, it is a very messy field, of which the dipole is only a small component, as it were. It has other formations, too. It has, of course, frequently a formation seen in the corona where lines of force, not just in the dipole, shape an arch. And of course, any such region will be in principle a a possible storage region for particles just the same as arches of the Earth's more nearly dipole field are storages for the Van Allen particles.

Just the same as here, you have a field arched like that, and it is able to hold particles in. So any kind of arch -- it wouldn't have to be just that shape -- such as we know to be commonly occurring on the sun, would also be a storage reservoir.

QUESTION: Are you saying that during normal days there are particles coming from the sun steadily, and during the solar storm we get higher energy particles coming?

PROF. GOLD: Well, the first part of the statement, some of us think that; we are not sure. The suggestion is that on some occasions a big whiff of something comes to us. Whatever happens the rest of the time, we are not sure.

QUESTION: Are particles coming steadily or not?

PROF. GOLD: We are not sure. Some of us think that particles come steadily from the sun, but it is sure that just on the occasion of a storm a much greater bulk comes here.

QUESTION: Wouldn't the Van Allen Layer disappear if there wasn't replenishment steadily?

PROF. GOLD: Yes, but we think it gets replenished only on some occasions.

QUESTION: The Argus shots showed they disappeared in a couple days, the Argus electrons.

PROF. CHRISTOFILOS: Who said that?

QUESTION: You did.

PROF. CHRISTOFILOS: I did?

QUESTION: Didn't the Argus tests disappear in a few days?

PROF. CHRISTOFILOS: In a few weeks there were still traces. After a few weeks.

PROF. GOLD: That is because they had merged into the background, possibly.

QUESTION: The statement is that the particles did not diffuse, that they held to about a hundred miles.

PROF. GOLD: We will come to it. The point is, as Dr. Jastrow stated earlier, that the calculation of storage times makes it rather long.

The particular details of the Argus shot have to be discussed separately because they were not fed into the best place for long storage. Particles were fed in at rather low levels.

What we do suppose and what is so strongly suggested by this, you see, for this outer region, is that it is during the magnetic storm that the supply is made. So that the magnetic storm brings with it slow gas and some fast particles.

QUESTION: If I visualize this, would you look at it in terms of an elongation of force from the Earth's dipole except it would be stretching out from the sun with a gang of slow particles travelling on it?

PROF. GOLD: I really think in terms of a great elongation of a solar field, and a great outburst, making some sort of elongated magnetic field travelling toward the Earth, with the gas content and all, and within it the possibility of spiralling fast particles which eventually sweep over the Earth.

QUESTION: You have a sort of focusing effect by this field?

PROF. GOLD: A guiding effect. But of course it isn't focused toward the Earth.

QUESTION: It is focused in outer space and the Earth happens to pass through it?

PROF. GOLD: Yes. This would suggest, if that kind of outlook is right, that on an occasion when such an outburst is occurring, if we have a space vehicle out there at that time we might see a great intensity of flux, not only the captured flux in the Earth's field but far out, far away.

QUESTION: How much greater would you estimate?

PROF. GOLD: As great as the intensity that occurs in here, or even more.

QUESTION: Under what circumstances would you see that when you were up there?

PROF. GOLD: During an effective magnetic storm. That is what would have to occur on this type of interpretation.

QUESTION: With a short lifetime?

PROF. GOLD: Just a matter of a couple of hours.

QUESTION: Dr. Gold, wouldn't this theory suggest that other planets also have this radiation belt?

PROF. GOLD: We are not sure of magnetic fields on other planets. We think it likely that Venus is rather similar to the Earth. It probably also has a field. It is closer to the sun. So if anything all these effects are greater. Mars is sufficiently different from the Earth so we are not sure.

QUESTION: Are you saying that the inner belt is electrons?

PROF. GOLD: I am not saying anything about that. Certainly it is a mixture of electrons and protons.

QUESTION: Somebody is hypothesizing that if there weren't this hole over South Africa, the two belts would be one.

PROF. GOLD: No, I don't think that is really an adequate explanation of the hole. It requires a very specific way of supplying the particles in that zone so that a sufficient number would fall into the hole.

QUESTION: What is your theory?

PROF. GOLD: I favor the point of view that there is a mechanism in which the particles from out here can get in there, and that there is a particular stability of the magnetic structures up here which is higher as you go further out, and allows the inner part to perform a rather complicated motion which the outer part is not performing. The thing is somewhat analogous to the case in the atmosphere where you have, for example, because the lowest part is convecting and the upper part is not convecting, a minimum of the temperature as you go up. It is warm at the bottom and it gets cold as you go up and then it gets hot again. In that case that convection can occur at some height and not above that height.

It is a rather complicated story and I wouldn't be able to put it across in a short time.

MR. ROSEN: We have been at this an hour, gentlemen. Why don't we give Mr. Christofilos a chance to make a brief summary.

PROF. CHRISTOFILOS: On the outer belt of radiation it seems rather possible, as Prof. Gold proposes, that it actually comes from solar activity, and the best indication thus far is this anomaly which was discovered in Pioneer IV. However, for the inner belt it appears to be quite difficult to have particles come from outside, especially relying on certain experimental results from the Argus experiment.

And the most important result we had in the Argus experiment was that for several weeks the belt, the thin layer, this hundred miles or so layer, stayed in the same place without moving but maybe ten or twenty miles, which means if there are such convection currents, these currents will take a year to go from the outer to the inner belt, which is of the order of the inner belt lifetime.

Furthermore, as developed at this meeting, it is quite likely that the particles in the inside are high energy, many of them, and so the explanation which has been proposed by Dr. Singer that our high energy neutrons come out, indicates perhaps the best explanation for the inner belt.

My opinion is that the inner belt actually contains particles which are born there where they are trapped.

QUESTION: Are we getting that amount of cosmic rays hitting our atmosphere all the time?

PROF. CHRISTOFILOS: We get them all the time, and they disintegrate oxygen and nitrogen nuclei.

QUESTION: We are told that the outer layer has a soft component and a hard component.

PROF. CHRISTOFILOS: I don't know too much about that.

QUESTION: The inner layer also has a hard component and a soft component?

PROF. CHRISTOFILOS: Yes. There are soft components.

QUESTION: What is the difference? They both have hard and soft components?

PROF. CHRISTOFILOS: Yes. The inner layer is much harder. The outer layer is much softer.

That, you should ask the men, who measure those things, Dr. Van Allen's group.

QUESTION: What is the hard component of the inner layer?

PROF. GOLD: These figures are not known. It is known there is a somewhat higher component of the hard component in the inner zone than outer. Both possess either. But the inner zone has a higher proportion of hard stuff.

QUESTION: Did you put any rough numbers on these proportions?

PROF. CHRISTOFILOS: You are asking the wrong people. The people who measure those things are not here.

DR. JASTROW: If you want to measure the ratio of hard to soft in the two belts?

QUESTION: Yes.

DR. JASTROW: You can only make a qualitative statement as Dr. Gold stated.

QUESTION: I had believed from previous statements that in our experiments we had thus far not been able to distinguish the components.

PROF. CHRISTOFILOS: Dr. McIlwain came in the meeting and said they were able to distinguish by a post mortem analysis of the counter data.

DR. JASTROW: This is a new result.

QUESTION: Could you describe that?

DR. JASTROW: Yes.

Prof. Gold is a skeptic. He doesn't believe it entirely.

PROF. GOLD: I am not saying that. But you can't put it across in the next five minutes.

MR. ROSEN: Would you credit this?

DR. JASTROW: The person who reported it for Van Allen and his collaborators is Carl E. McIlwain, one of Van Allen's collarborators. He and Ray, another of Van Allen's collaborators, present at our conference, reported the following.

Let me say first that Van Allen discovered all the radiation is in a narrow disk. That is item number one.

Second, he has a counter and this counter has a window in it. The window of the counter is here (indicating). This window is very thin. The walls of the counter are relatively thick. The soft particles can only come into this counter through the window. They can not get through the thick walls.

The energetic particles, the penetrating ones, can get through the thick walls.

With this preliminary, consider what happens if the counter is oriented, let us say, so, with thick walls, and thin window, and is spinning. Whenever the position of the counter --- as the satellite spins --- is such that the thin window faces into the direction of the radiation, then the soft radiation can penetrate that window and be counted.

But when the counter has a different orientation then only the hard radiation can enter.

In this way you eliminate the soft particles from the hard one because you find that your counting rate looks something like this (blackboard).

These peaks represent the orientation of the counter when the window is facing the direction of the radiation.

The minima, in between, represent the case where the soft radiation was excluded because of the thick walls encountered in the direction of the radiation.

That means that in the minimum the counting rate measures only hard radiation.

Now, by reasoning which is perhaps too complicated, you combine the fact that the energy of these particles is sufficient to get through that thick wall, with the information that you have on the amount of energy deposited in the counter. The combination of these two pieces of information tells you what is called the specific ionization of the particles. That specific ionization is very different for protons and electrons, and the value of the specific ionization which they obtain by this ingenious rough argument corresponds to protons and excludes the possibility of electrons.

QUESTION: This is the case in both the inner and outer belts?

DR. JASTROW: No; this is a post mortem analysis on Explorer IV and therefore refers to the inner belt. Explorer IV only penetrated into the inner belt.

QUESTION: So it is still a mystery as to whether the outer belt is protons or electrons?

DR. JASTROW: Yes, except for the fact that the Russians have stated that the soft component in the outer belt consists of electrons.

McIlwain said that their data suggests this, too, although they are not certain.

QUESTIONS: The hard may be protons or energetic electrons?

DR. JASTROW: That is correct.

QUESTION: When you say the window is facing in the direction of the radiation, you mean that it was facing the direction which was perpendicular to the line of force so that the electrons travelling in a spiral could enter?

DR. JASTROW: That is correct.

QUESTION: Were they also able to correlate the antenna pattern analysis, the orientation of the satellite --

PROF. GOLD: To a considerable extent. To the extent of making it extremely plausible, to say the least. The radiation was mainly going at that place in fairly tight spirals across the lines of force, with spirals running along the lines of force, and this fitted in with all the motion that they could deduce from the variation of the pattern and from the time constant of the spin and tumble which they knew independently.

(Whereupon, at 5:45 p.m., the Conference was concluded)